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BEFORE THE

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"NASA Mgt. Program"

THIS IS A SIGNIFICANT WEEK IN THE HISTORY OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FOR MANY REASONS AND A MOST APPROPRIATE ONE FOR MY DISCUSSION WITH YOU.

IT IS A VERY SPECIAL PLEASURE TO BE WITH YOU A FEW HOURS BEFORE I LEAVE FOR CAPE KENNEDY WHERE IN THREE DAYS THE UNITED STATES WILL FLY THE APOLLO 7 ON ITS FIRST MANNED MISSION SINCE GEMINI 12 RETURNED TO EARTH ON NOVEMBER 15, 1966.

ONLY A FEW DAYS AGO WE PASSED THE TENTH ANNIVERSARY OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, AND ONLY YESTERDAY OUR LONG-TIME ADMINISTRATOR, JIM WEBB, RETIRED AFTER EIGHT YEARS OF FINELY FOCUSED DRIVE AND ENERGY. ALL OF YOU KNOW WITH WHAT DEDICATION HE APPLIED HIS MANY TALENTS TO THE CREATION OF THE GREAT CAPABILITY WHICH WE HAVE TODAY. I WOULD LIKE TO STRESS THE IMPORTANCE OF THE BASE WHICH HE HAS BUILT AS THE FOUNDATION OF OUR FUTURE IN SPACE.

TOMORROW AT 1 O'CLOCK AT CAPE KENNEDY, APOLLO 8, SCHEDULED FOR LAUNCH IN DECEMBER, ROLLS OUT TO LAUNCH PAD A, HAVING BEEN ASSEMBLED AND FULLY TESTED IN THE VEHICLE ASSEMBLY BUILDING.

ON FRIDAY, OCTOBER 11, APOLLO 9, SCHEDULED FOR LAUNCH EARLY IN 1969, WILL BE FULLY STACKED IN THE VERTICAL ASSEMBLY BUILDING AND READY FOR TESTING.

AT THIS MOMENT MANY REPRESENTATIVES OF YOUR NEWSPAPERS AND THE UNITED PRESS INTERNATIONAL ARE COVERING PRELAUNCH ACTIVITIES AT CAPE KENNEDY AND THE MANNED SPACECRAFT CENTER IN HOUSTON. A SIZEABLE NEWS POOL IS ON THE CARRIER ESSEX, THE PRIME RECOVERY VESSEL IN THE ATLANTIC.

WHAT I HOPE TO DO TODAY IS RECALL OUR ACCOMPLISHMENTS TO DATE AND SKETCH FOR YOU THE APOLLO FLIGHT ACTIVITY WHICH WILL LEAD TO A MANNED LANDING ON THE MOON AND RETURN TO EARTH BEFORE THE END OF NEXT YEAR.

I THINK YOU WILL AGREE THAT WE HAVE INDEED MADE GREAT PROGRESS IN THE SEVEN YEARS SINCE MAN FIRST VENTURED INTO SPACE AND IN THE 10 YEARS SINCE THE ESTABLISHMENT OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION.

IN A SHORT SPAN OF TIME, MINUTE IN TERMS OF HISTORY, MAN'S ABILITY TO LIVE AND WORK IN SPACE HAS BEEN PROVEN AND THE TECHNOLOGY CREATED TO SUPPORT HIS MEANINGFUL PRESENCE IN SPACE. APOLLO AND THE EARLIER MERCURY AND GEMINI PROGRAMS REPRESENT GREAT STRIDES TOWARD MASTERY OF THIS NEW ENVIRONMENT. MERCURY AND GEMINI PRODUCED ACCOMPLISHMENTS WHICH HAD BEEN IN THE REALM OF SCIENCE-FICTION ONLY A FEW YEARS AGO. AMONG THESE ACHIEVEMENTS ARE THE LONGEST MANNED FLIGHT, 330 HOURS; THE HIGHEST ALTITUDE EVER ATTAINED BY MAN, 850 MILES; THE ACCUMULATION OF 2000 HOURS OF MANNED SPACE FLIGHT BY 18 ASTRONAUTS,

INCLUDING 12 HOURS OF EXTRAVEHICULAR ACTIVITY; THE GREATEST NUMBER OF MILES TRAVELED ON ONE MISSION, 5,129,400 AND THE GREATEST NUMBER OF REVOLUTIONS ABOUT THE EARTH ON ONE FLIGHT, 206. FINALLY, RENDEZVOUS AND DOCKING AND INSPECTION WERE ACCOMPLISHED NINE TIMES, USING SEVEN DIFFERENT METHODS.

IN ADDITION, WE HAVE BEEN SUCCESSFUL IN 14 CONSECUTIVE UNMANNED MISSIONS WITH THE SATURN I AND SATURN IB LAUNCH VEHICLES AND OUR FIRST TWO SATURN V FLIGHTS HAVE BROUGHT US TO THE POINT WHERE WE WILL MAN THE THIRD FLIGHT LATE THIS YEAR.

WITH THESE ACHIEVEMENTS BEHIND US, WE ARE MOVING INTO THE MANNED PHASE OF THE APOLLO PROGRAM WITH CONFIDENCE THAT THE HARD WORK BY THOUSANDS OF PEOPLE IN GOVERNMENT AND CONTRACTOR ORGANIZATIONS HAS MADE THE APOLLO/SATURN SYSTEM AS RELIABLE AS HUMANLY POSSIBLE.

NOW, I'D LIKE TO TELL YOU ABOUT THE APOLLO FLIGHT SYSTEM.

TWO LAUNCH VEHICLES, THE SATURN I AND THE SATURN V, PROVIDE THE PROPULSION OR POWER TO PUT THE APOLLO SPACECRAFT IN SPACE. THE SATURN I ROCKET IS USED FOR EARTH ORBITAL FLIGHTS SUCH AS THE APOLLO 7 MISSION. IT HAS A LIFTOFF THRUST OF 1.6 MILLION POUNDS, OR ABOUT FOUR TIMES AS MUCH POWER AS THE TITAN II WHICH LAUNCHED GEMINI SPACECRAFT.

THE SATURN V HAS 7.5 MILLION POUNDS OF THRUST AT LIFTOFF. WITH THE APOLLO SPACECRAFT, IT STANDS 363 FEET

TALL, TWO-THIRDS AS TALL AS THE WASHINGTON MONUMENT. IT WEIGHS MORE THAN SIX MILLION POUNDS, AS MUCH AS EIGHT C-5 AIRCRAFT AND CAN PUT 285,000 POUNDS IN EARTH ORBIT OR SEND 100,000 POUNDS TO THE MOON.

THE SATURN V HAS 5,600,000 PARTS. IF WE HAD A 99.9 PERCENT RELIABILITY FOR THE FLIGHT THERE WOULD STILL BE 5,600 DEFECTIVE PARTS. YET, THE APOLLO 4 MISSION FLEW A "TEXTBOOK" FLIGHT WITH ONLY TWO ANOMALIES OCCURRING, DEMONSTRATING A RELIABILITY OF 99,9999+ PERCENT. IF AN AVERAGE AUTOMOBILE WITH 13,000 PARTS WERE TO HAVE THIS SAME RELIABILITY, IT WOULD HAVE ITS FIRST DEFECTIVE PART IN ABOUT 100 YEARS. IN FACT, ITS LIFE WOULD BE DETERMINED BY RUST OR WEAR AND NOT BY MECHANICAL FAILURE.

THE APOLLO SPACECRAFT IS MADE UP OF THREE ELEMENTS -- THE COMMAND, SERVICE, AND LUNAR MODULES. THE COMMAND MODULE IS A CONE ABOUT 12 FEET HIGH AND 13 FEET WIDE AT THE BASE. IT HAS ROUGHLY TWICE THE VOLUME OF THE GEMINI SPACECRAFT AND IS THE COMMAND POST OF THE THREE-MAN APOLLO SPACECRAFT SYSTEM.

THE SERVICE MODULE, ATTACHED TO THE BASE OF THE COMMAND MODULE, CONTAINS THE FUEL CELL ELECTRICAL POWER SYSTEM AND ROCKET ENGINES FOR MANEUVERING THE APOLLO SPACECRAFT AFTER IT IS DETACHED FROM THE SATURN LAUNCH VEHICLE. IT ALSO CONTAINS THE OXYGEN SUPPLY FOR THE CREW.

THE LUNAR MODULE IS DESIGNED TO CARRY THE ASTRONAUTS FROM ORBIT AROUND THE MOON TO THE LUNAR SURFACE, PROVIDE A BASE FROM WHICH TO WORK WHILE ON THE MOON AND THEN CARRY THEM BACK TO THE COMMAND MODULE FOR THE RIDE HOME.

ON OCTOBER 11, WALTER SCHIRRA, WALTER CUNNINGHAM AND DONN EISELE WILL FLY THE SATURN IB ON A MISSION PRIMARILY AIMED AT PROVING THE COMMAND AND SERVICE MODULES. THE PRIMARY OBJECTIVES OF THE FLIGHT ARE TO "WRING-OUT" THIS NEW GENERATION OF SPACECRAFT. THE SPACECRAFT SYSTEMS PERFORMANCE WILL BE MONITORED BY ONBOARD AND TELEMETERED DATA. THE PERFORMANCE OF THE CREW, PRIME AND BACKUP SPACECRAFT SYSTEMS AND MISSION SUPPORT FACILITIES IN EARTH ORBIT WILL BE CHECKED OUT. A TRANSPOSITION AND SIMULATED DOCKING MANEUVER WITH THE SATURN IVB STAGE WILL BE PERFORMED AS WELL AS MANY OTHER CHECKS OF EQUIPMENT AND PROCESSES.

APOLLO 7 IS THE FIRST FULL USE IN THE MANNED PROGRAM OF THE "OPEN END" MISSION CONCEPT. AS YOU RECALL IN THE GEMINI PROGRAM WE BUILT UP OUR FLIGHT EXPERIENCE AND VERIFIED THE DESIGN OF THE SPACECRAFT IN A SERIES OF STEPS, BEGINNING WITH A THREE-ORBIT FLIGHT, THEN FLIGHTS OF FOUR, EIGHT AND FINALLY 14 DAYS.

IN APOLLO 7 WE ARE CARRYING OUT THE SAME SET OF STEPS BUT INSTEAD OF STOPPING AFTER EACH ONE AND RETURNING TO EARTH, WE ARE USING THE CAPABILITY OF OUR TELEMETRY NETWORK TO EVALUATE IN REAL TIME THE READINESS OF THE

SPACECRAFT TO TAKE THE NEXT STEP. IF ALL GOES WELL, WE WILL BE ABLE TO ACCOMPLISH AS MUCH IN TERMS OF DESIGN VERIFICATION IN THE FIRST MANNED FLIGHT OF THE APOLLO SPACECRAFT AS WE DID IN THE FIRST FIVE MANNED GEMINI FLIGHTS.

IN ORDER TO MAXIMIZE THE RETURNS FROM THE FLIGHT, WE HAVE ALSO ARRANGED THE FLIGHT PLAN SO THAT THE PRIMARY AND SECONDARY OBJECTIVES OF THE APOLLO 7 MISSION ARE COMPLETED AS EARLY IN THE MISSION AS POSSIBLE. THUS WE WILL ACCOMPLISH ALL THE PRIMARY OBJECTIVES IN THE FIRST THREE DAYS AND IN TERMS OF THE PARTIAL ACCOMPLISHMENT OF THE PRIMARY OBJECTIVES WE WILL HAVE COMPLETED ABOUT 1/3 IN THE FIRST SIX ORBITS, 2/3 IN THE FIRST DAY AND OVER 90 PERCENT BY THE END OF THE 32ND ORBIT, THE END OF THE SECOND DAY.

APOLLO 7 IS SCHEDULED FOR LAUNCH AT 11:00AM FRIDAY INTO AN ORBIT RANGING FROM 142 TO 176 MILES. SPACECRAFT SYSTEMS CHECKOUT WILL BE THE PRINCIPAL ACTIVITY DURING THE FIRST TWO REVOLUTIONS.

NEAR THE END OF THE SECOND REVOLUTION, THE CREW WILL SEPARATE THE SPACECRAFT FROM THE SECOND STAGE AND PERFORM A SIMULATED DOCKING MANEUVER, USING THE SPACECRAFT LUNAR MODULE ADAPTER ATTACHED TO THE SECOND STAGE AS A TARGET.

EXTENSIVE OPERATIONAL CHECKOUTS OF THE SPACECRAFT'S ENVIRONMENTAL CONTROL, GUIDANCE AND NAVIGATION, AND SERVICE PROPULSION SYSTEMS, WILL OCCUPY THE CREW FOR

THE NEXT SEVERAL REVOLUTIONS. INCLUDED WILL BE A RENDEZVOUS WITH THE SECOND STAGE OF THE LAUNCH VEHICLE APPROXIMATELY 30 HOURS AFTER LIFTOFF. THE MAJOR MANEUVERS BY THE COMBINED COMMAND AND SERVICE MODULES WILL BE MADE BY USING THE SERVICE PROPULSION SYSTEM, A 20,500-POUND-THRUST ROCKET ON THE SERVICE MODULE.

CREW ACTIVITIES, SYSTEMS PERFORMANCE, AND GROUND SUPPORT FACILITIES WILL BE EVALUATED DURING THE REMAINDER OF THE MISSION. ADDITIONAL OPERATIONS OF THE SERVICE PROPULSION SYSTEM ARE SCHEDULED DURING THIS PHASE.

IF ALL GOES WELL, TEN DAYS, 21 HOURS AFTER LIFTOFF, THE CREW WILL FIRE THE SERVICE PROPULSION SYSTEM TO DECREASE THE SPEED OF THE SPACECRAFT AND BEGIN ITS RETURN FROM ORBIT.

APOLLO 7 LANDING IS PLANNED IN THE ATLANTIC OCEAN ABOUT 230 MILES SOUTH-SOUTHWEST OF BERMUDA.

WE PLAN TO LAUNCH APOLLO 8 IN DECEMBER. THIS WILL BE THE FIRST MANNED OPERATION OF THE SATURN V, THE ROCKET DESIGNED TO LAUNCH MANNED MISSIONS TO THE MOON. ASTRONAUTS FRANK BORMAN, JAMES LOVELL AND WILLIAM ANDERS WILL FLY THE COMMAND AND SERVICE MODULES FOR ANOTHER TEST OF ITS SYSTEMS AND REHEARSAL OF SOME OF THE SPACE MANEUVERS REQUIRED FOR LUNAR LANDING MISSIONS. AS IN APOLLO 7, A LUNAR MODULE WILL NOT BE CARRIED ON THIS MISSION.

THE FLIGHT PLAN FOR APOLLO 8 WILL NOT BE DETERMINED UNTIL WE EVALUATE THE APOLLO 7 MISSION. HOWEVER, THERE

ARE SEVERAL ALTERNATIVES AVAILABLE, ALL OF WHICH WOULD ADVANCE THE OPERATIONAL STATUS OF THE APOLLO PROGRAM.

FIRST, IF APOLLO 7 DOES NOT ACHIEVE ITS PRINCIPAL OBJECTIVES, FLIGHT QUALIFICATION OF THE SPACECRAFT COULD BE ACCOMPLISHED WITH APOLLO 8 REPEATING ESSENTIALS OF THE APOLLO 7 MISSION. THIS IS THE MOST LIKELY MISSION ASSIGNMENT OF APOLLO 8. SHOULD THE APOLLO 7 MISSION INDICATE THAT A SYSTEM OR SOME EQUIPMENT REQUIRES MODIFICATIONS, CHANGES COULD BE FLIGHT TESTED DURING APOLLO 8.

THE MAN-RATING OF THE SATURN V IS A PRIMARY OBJECTIVE OF APOLLO 8. THE POSSIBILITY DOES EXIST FOR APOLLO 8 TO BE A MANNED FLIGHT ORBITING THE MOON.

I WISH TO STRESS THAT, EVEN IF NEXT WEEK'S FLIGHT SHOULD APPEAR TO BE AN UNQUALIFIED SUCCESS, APOLLO 8 WILL NOT BE COMMITTED TO ANYTHING MORE THAN AN EARTH ORBITAL MISSION UNTIL AFTER THE MOST CAREFUL EVALUATION OF THE RESULTS OF APOLLO 7 AND STATUS OF THE APOLLO 8 HARDWARE, A PROCESS WHICH WILL TAKE UNTIL LATE NOVEMBER.

AN APOLLO 8 LUNAR ORBITAL MISSION WOULD PROVIDE PHOTOGRAPHS IN COLOR OF APOLLO LUNAR LANDMARKS AND LANDING SITES AND OTHER AREAS OF THE MOON.

TECHNOLOGICALLY, A LUNAR ORBIT MISSION WOULD VERIFY THE SATURN V AND APOLLO SPACECRAFT SYSTEMS FOR DEEP SPACE OPERATIONS, WITH THE EXCEPTION OF THE ACTUAL LUNAR LANDING AND LAUNCHING SEQUENCES.

FIVE APOLLO MISSIONS ARE PLANNED IN 1969 AND I BELIEVE IT IS REASONABLE TO EXPECT THAT WE WILL BE ABLE TO CARRY OUT A LUNAR LANDING MISSION BY THE FOURTH OR FIFTH OF THESE.

THE FIRST OF THE 1969 FLIGHTS IS SCHEDULED FOR FEBRUARY OR MARCH, WHEN ASTRONAUTS JIM McDIVITT, DAVID SCOTT, AND RUSSELL SCHWEICKART FLY THE COMPLETE THREE-MODULE APOLLO SPACECRAFT. IT WILL BE THE FIRST MANNED OPERATION OF THE LUNAR MODULE IN SPACE.

THIS OPEN-ENDED MISSION OF UP TO 10 DAYS DURATION IS PLANNED TO PERFORM VARIOUS RENDEZVOUS AND DOCKINGS OF THE COMMAND MODULE AND LUNAR MODULE. McDIVITT, THE MISSION COMMANDER, AND SCHWEICKART, THE LUNAR MODULE PILOT, WILL ENTER THE LUNAR MODULE THROUGH A TUNNEL WHICH CONNECTS WITH THE COMMAND MODULE. THE TWO LUNAR MODULE ENGINES WILL BE FIRED IN A MANNED OPERATION FOR THE FIRST TIME WHILE McDIVITT AND SCHWEICKART ARE AT THEIR POSTS IN THAT VEHICLE. WHILE THE TWO MODULES ARE DOCKED, SCHWEICKART WILL TRANSFER FROM THE LUNAR MODULE TO THE COMMAND MODULE IN A PROCEDURE TO BE USED IN THE EVENT THE USUAL THROUGH-TUNNEL METHOD IS IMPOSSIBLE. OUTSIDE LIGHTING AND HAND RAILS HAVE BEEN INSTALLED ON BOTH MODULES SO THAT THE CREWS WILL BE ABLE TO MAKE SUCH A TRANSFER, IF NECESSARY, DURING DARK PERIODS OF FLIGHT. THIS WILL BE THE FIRST SPACE WALK IN THE APOLLO PROGRAM AND THE ONLY ONE PLANNED BEFORE THE MOON-LANDING MISSION.

IF THE FIRST MANNED LUNAR MODULE OPERATIONS ARE SUCCESSFUL, THE FOLLOWING MISSION COULD SIMULATE A LUNAR LANDING MISSION OPERATION IN A 4,000-MILE-HIGH EARTH ORBIT. IT WOULD BE A "DRESS REHEARSAL" OF A LUNAR LANDING. IT IS EXPECTED TO FULFILL OPERATIONAL REQUIREMENTS NEEDED BEFORE A LUNAR MISSION IS UNDERTAKEN.

EACH APOLLO/SATURN V FLIGHT REPRESENTS A MAJOR STEP IN DEMONSTRATING OUR CAPABILITY - BUT OF COURSE, THE CONSEQUENCE OF THESE GIANT STEPS IS THAT THE PLANS FOR EACH FLIGHT DEPEND ON RESULTS OF PREVIOUS MISSIONS, AS WELL AS STATUS OF SUPPORTING PROGRAMS.

THE MANNED LUNAR LANDING FLIGHT -- FROM LIFTOFF TO RECOVERY AND RETURN OF THE LUNAR SAMPLES AND ASTRONAUTS TO THE LUNAR RECEIVING LABORATORY AT HOUSTON -- WILL BE AN OPEN OPERATION IN KEEPING WITH THE POLICIES ESTABLISHED WHEN NASA WAS CREATED 10 YEARS AGO.

WHENEVER POSSIBLE, COVERAGE WILL BE OPEN TO ALL. WHERE SPACE IS RESTRICTIVE, SUCH AS ON RECOVERY SHIPS AND THE LUNAR RECEIVING LABORATORY, NEWS POOL TEAMS REPRESENTING ALL MEDIA WILL BE ESTABLISHED.

I MENTION NASA'S MANNED FLIGHT PUBLIC INFORMATION ACTIVITIES NOT SO MUCH BECAUSE I AM SPEAKING TO A GROUP OF EDITORS, BUT BECAUSE THE OPENNESS OF OUR PROGRAM HAS ACCELERATED THE IMPACT OF THE SPACE AGE ON ALL ASPECTS OF OUR NATIONAL LIFE.

THE MANNED LUNAR LANDING IS NOT AN END IN ITSELF, BUT WHEN TWO AMERICAN ASTRONAUTS RETURN FROM THE SURFACE OF THE MOON, WE WILL MARK THE ACCOMPLISHMENT OF OUR GREATEST NATIONAL PEACETIME GOAL. WE WILL HAVE FIRMLY ESTABLISHED AND DRAMATICALLY DEMONSTRATED TO ALL THE WORLD THE UNITED STATES' CAPABILITY TO OPERATE IN THIS NEW OCEAN -- A QUARTER OF MILLION MILES FROM EARTH!

THIS NATION HAS DEVELOPED AND BUILT THE FACILITIES AND THE CAPABILITY FOR THE INVESTIGATION AND UTILIZATION OF A NEW ENVIRONMENT. OVER \$4 BILLION HAS BEEN INVESTED IN FACILITIES INCLUDING AMONG OTHERS, THE MISSISSIPPI TEST FACILITY AT BAY ST. LOUIS, THE MANNED SPACECRAFT CENTER AT HOUSTON AND THE KENNEDY SPACE CENTER AT CAPE KENNEDY IN FLORIDA.

WITH NASA AS THE CATALYST, WITH THE NEEDS OF THE SPACE PROGRAM AS THE SPUR, AMERICAN INDUSTRY HAS AGAIN DEMONSTRATED ITS RESOURCEFULNESS AND CAPABILITY.

A MEASURE OF THIS CAPABILITY TO CARRY OUT FORWARD-LOOKING NEW PROGRAMS, IS OUR RECORD OF ACHIEVEMENT. SINCE OCTOBER 1, 1958, NASA HAS COMPLETED 234 UNITED STATES AND INTERNATIONAL LAUNCHES, NOT INCLUDING THOUSANDS OF SOUNDING ROCKETS OR FLIGHTS OF THE THREE X-15 ROCKET-PROPELLED AIRCRAFT.

THROUGH THESE SPACE FLIGHT ACTIVITIES AND SUPPORTING RESEARCH AND DEVELOPMENT ACTIVITY IN ITS OWN LABORATORIES

AND IN INDUSTRY FACILITIES, NASA HAS PROVIDED THE NATION WITH:

1. AN OPERATIONAL COMMUNICATIONS SATELLITE CAPABILITY THAT CREATED AN ENTIRELY NEW INDUSTRY.
2. OPERATIONAL WEATHER SATELLITE SYSTEMS THAT PROVIDE GLOBAL WEATHER INFORMATION 24 HOURS A DAY.
3. DETAILED MAPPING OF THE MOON, INCLUDING CLOSEUP PICTURES AND EXAMINATION OF THE LUNAR SURFACE.
4. PICTURES OF THE SURFACE OF MARS AND NEW MEASUREMENTS OF GREAT SCIENTIFIC VALUE FROM SPACE PROBES OF THE CHARACTERISTICS OF MARS, VENUS, AND THE SUN.
5. A GREAT VOLUME OF NEW INFORMATION ON THE NEAR SPACE ENVIRONMENT OF THE EARTH, INCLUDING THE INTERACTION OF THE MAGNETIC FIELD AND ENERGETIC PARTICLES FROM THE SUN.
6. A CONTINUING CONTRIBUTION THROUGH AERONAUTICAL RESEARCH TO BOTH MILITARY AND CIVILIAN AVIATION INCLUDING DIRECT SUPPORT IN THE DEVELOPMENT OF THE SUPERSONIC TRANSPORT.
7. DEVELOPMENT OF MANNED SPACE FLIGHT SYSTEMS IN MERCURY, GEMINI AND APOLLO THAT MAKE IT POSSIBLE FOR TRAINED SCIENTIFIC OBSERVERS TO INSPECT OTHER OBJECTS IN SPACE; MAKE SCIENTIFIC MEASUREMENTS; PHOTOGRAPH IN DETAIL THE SURFACE OF THE EARTH; OBSERVE AND REPORT ON THE WEATHER, AND MOST IMPORTANTLY, APPLY CRITICAL HUMAN JUDGMENT TO WHATEVER MISSION MUST BE PERFORMED.

FOR THE CONCEPTION AND CONSTRUCTION OF THE EQUIPMENT NECESSARY TO THE SAFE TRANSPORT OF MEN INTO SPACE AND FOR THEIR ACCOMPLISHMENT OF PRODUCTIVE TASKS IN THAT NEW ATMOSPHERE, A NEW MIX OF PROFESSIONAL AND SCIENTIFIC DISCIPLINES HAS BEEN CREATED WHICH HAS FORCED COOPERATION BETWEEN ENGINEERS AND MEDICAL DOCTORS, CHEMISTS AND ASTRONOMERS, OCEANOGRAPHERS AND GEOLOGISTS.

MANY OF THE TECHNOLOGIES WHICH ARE ESSENTIAL TO OUR SENDING THREE MEN TO THE MOON AND BACK, DID NOT EXIST A FEW YEARS AGO. THEY HAD TO BE INVENTED, ADAPTED OR DEVELOPED. WE DID JUST THAT -- WE INVENTED, ADAPTED AND DEVELOPED.

WE NOW HAVE THE GIANT BOOSTERS WHICH HAVE RELEASED MAN FROM HIS ATMOSPHERE, AND WE HAVE INVENTED THE LIFE-SUPPORT SYSTEMS THAT CAN MAINTAIN HIM IN SPACE.

AS A RESULT OF THE CLEANLINESS REQUIREMENTS OF THE SPACE PROGRAM WE HAVE THE LARGEST "CLEAN ROOMS" IN THE WORLD--ROOMS WHICH HOSPITALS ARE NOW EMULATING.

THE REQUIREMENTS OF THE SPACE PROGRAM FOR A WORLDWIDE COMMUNICATIONS NETWORK DEMANDED MAJOR

IMPROVEMENTS IN THE STATE OF THE ART OF COMPUTER TECHNOLOGY. OVER 600 COMPUTERS NOW COMPRISE THE LARGEST AND MOST ADVANCED COMMUNICATIONS SYSTEM IN THE WORLD.

THE FUEL CELL, WHICH HAD LAIN DORMANT FOR MANY YEARS, WAS ACTIVATED TO POWER SPACECRAFT IN ORBIT. THIRTY PUBLIC UTILITY COMPANIES NOW HAVE A \$27,000,000 PROGRAM FOR THE ADAPTATION OF THE FUEL CELL FOR HOME POWER UNITS.

WE HAD TO KNOW ON A REAL-TIME BASIS, HOW FAST THE HEARTS OF THE ASTRONAUTS WERE BEATING WHILE THEY WERE IN SPACE. WE HAD TO KNOW HOW MUCH OXYGEN THEY WERE USING, AND HOW THEIR MUSCLES WERE RESPONDING TO THEIR STRANGE ENVIRONMENT. SO WE INVENTED ANOTHER NEW SYSTEM, BIOSENSOR TO COMPUTER TO DATA GATHERING EQUIPMENT, AND THROUGH THE COMMUNICATIONS NETWORK TO THE MANNED SPACECRAFT CENTER AT HOUSTON -- FROM 100 MILES -- OR 800 MILES, OR FROM A 1/4 OF A MILLION MILES OUT IN SPACE. AND A HALF A DOZEN NEWLY FORMED COMPANIES ARE NOW MANUFACTURING THESE ADAPTED SPACE-CREATED INSTRUMENTS FOR THE USE OF DOCTORS AND HOSPITALS HERE ON EARTH.

THE NEED FOR FIREPROOF MATERIALS FOR APOLLO SPACE-CRAFT HAS DEMANDED A COMPLETE TESTING AND DOCUMENTATION OF THE FLAMABILITY CHARACTERISTICS OF HUNDREDS OF MATERIALS. THESE RESULTS HAVE BEEN COMPUTERIZED AND ARE AVAILABLE FOR THE ASKING. WITHIN A SHORT TIME THERE WILL BE NO EXCUSE FOR A LARGE PERCENTAGE OF DISASTROUS FIRES -- FROM MATTRESSES BURNING TO CHILDRENS' SWEATERS CATCHING FIRE TO AIRCRAFT CURTAINS IGNITING. FIREPROOF BETA CLOTH HAS BEEN DEVELOPED WHICH IS ALREADY BEING USED FOR FIREFIGHTER SUITS IN MUNICIPAL DEPARTMENTS AS WELL AS ON BOARD OUR AIRCRAFT CARRIERS AT SEA.

NOW, WHERE DO WE GO FROM HERE?

THE HARDWARE, FACILITIES, AND TEAM DEVELOPED TO CARRY OUT THE APOLLO PROGRAM REPRESENT A MAJOR NATIONAL INVESTMENT. A RELATIVELY SMALL ADDITIONAL INVESTMENT WILL BE REQUIRED TO ADAPT THESE TO FUTURE PROGRAMS WHICH PROMISE SUBSTANTIAL PRACTICAL BENEFITS TO MAN.

THE ORBITAL WORKSHOP, NOW UNDER DEVELOPMENT IN THE APOLLO APPLICATIONS PROGRAM, IS A SPACE STATION UTILIZING FOR ITS COMPONENTS AND ITS LOGISTICS SUPPORT, STAGES, MODULES, AND SPACECRAFT WHICH WERE DEVELOPED IN THE APOLLO PROGRAM. IT WILL PROVIDE ACCOMMODATIONS FOR THREE PEOPLE AND THEIR EQUIPMENT FOR SEVERAL MONTHS IN ORBIT.

THE ORBITAL WORKSHOP IS THE PROGENITOR OF SPACE STATIONS THAT SHOULD BE USED FOR THE CONDUCT OF THE MANY SCIENTIFIC, TECHNOLOGICAL, AND COMMERCIAL EXPERIMENTS AND PROCESSES WHICH PLANNERS ARE NOW DESCRIBING.

THESE SPACE STATIONS WILL BE USED AS LABORATORIES IN ORBIT AND WILL PROVIDE THE FACILITIES TO STUDY AND UNDERSTAND THE NATURE OF SPACE. THEY WILL PROVIDE OBSERVATORIES TO VIEW THE SUN, THE PLANETS AND THE STARS BEYOND THE ATMOSPHERIC VEIL OF EARTH. STATIONS IN ORBIT WILL PROVIDE BASES FOR CONTINUOUS OBSERVATION OF THE EARTH AND ITS ATMOSPHERE ON AN OPERATIONAL BASIS -- FOR METEOROLOGICAL AND OCEANOGRAPHIC USES, FOR EARTH RESOURCE DATA GATHERING AND EVALUATION, FOR COMMUNICATIONS AND BROADCASTING, SPACE AND AIR TRAFFIC CONTROL AND CATASTROPHY ALERTS.

WEIGHTLESSNESS IN ORBITAL SPACE FLIGHT, A PHENOMENON REGARDED WITH APPREHENSION BEFORE MAN VENTURED INTO SPACE, OFFERS INTRIGUING POSSIBILITIES FOR MANUFACTURING IN SPACE. FOR INSTANCE, MATERIAL IN THE LIQUID STATE FLOATING IN A WEIGHTLESS ENVIRONMENT, TAKES THE SHAPE OF A PERFECT SPHERE. THUS, IT IS CONCEIVABLE THAT METAL BALL BEARINGS COULD BE MANUFACTURED IN SPACE TO TOLERANCES IMPOSSIBLE IN OUR PRESENT TECHNOLOGY YET AT A COST, INCLUDING TRANSPORTATION, LESS THAN WE CAN NOW ACHIEVE. SUCH BEARINGS WOULD REDUCE FRICTION AND NOISE LEVELS TO THE VANISHING POINT.

FURTHER, BY BLOWING GAS INTO MOLTEN METAL, PRECISION HOLLOW SPHERES CAN BE FORMED. THESE PRECISION HOLLOW SPHERES ARE BADLY NEEDED TO MOVE LARGE RADAR ANTENNAS, ROTATE LARGE AIRCRAFT WINGS AND TO SUPPORT LOADS IN LARGE JET ENGINES.

IF WE SPIN THE FREE FLOATING SPHERES DURING THE CHILLING PHASE WE CAN PRODUCE ACCURATE ELLIPSOID SHAPES TO TOLERANCES ABSOLUTELY IMPOSSIBLE TO PRODUCE ON EARTH. THE APPLICATION OF ELECTROSTATIC FIELDS COULD FORM THE MOLTEN METAL INTO MANY DIFFERENT SHAPES TO PRECISION TOLERANCES.

FREE-FALL CASTING TECHNIQUES COULD BE UTILIZED TO CAST LARGE FLAWLESS OPTICAL BLANKS FOR TELESCOPES AND BY PROPER COMBINATIONS OF SPINNING AND ELECTROMATIC FORCE WE SHOULD BE ABLE TO SHAPE THE SURFACE AS WELL.

STABLE FOAMS FROM A WIDE VARIETY OF LIQUIFIED MATERIALS AND GASES OFFER EXCITING POSSIBILITIES. SUCH FOAMS CANNOT BE SATISFACTORILY PRODUCED ON EARTH BECAUSE OF THE EFFECTS OF GRAVITY. IN WEIGHTLESSNESS, THE MIXING AND EQUAL DISTRIBUTION OF GAS BUBBLES IN ANY LIQUID CAN BE STABILIZED AND MOVED INTO A DESIRED PATTERN. USING THIS TECHNIQUE, WE CAN PRODUCE A STEEL FOAM HAVING THE WEIGHT OF BALSA WOOD BUT MANY OF THE PROPERTIES OF SOLID STEEL. OF MUCH MORE IMPORTANCE, COMBINED MATERIALS LIKE STEEL AND GLASS OF DRASTICALLY DIFFERENT DENSITIES AND PROPERTIES CAN ALSO BE PRODUCED.

SOME POTENTIAL APPLICATIONS OF THESE FOAM MATERIALS ARE EXTREMELY LIGHTWEIGHT ARMOR PLATES, VESTS AND HELMETS, VARIABLE DENSITY TURBINE BLADES AND INSULATION MATERIALS TO COMPENSATE FOR VERY HIGH TEMPERATURE GRADIENTS.

MANY PRODUCTS COULD UNDOUBTEDLY BE BETTER AND MORE ECONOMICALLY MANUFACTURED IN THE CLEAN VACUUM OF SPACE IN THE WEIGHTLESS STATE. MUCH THAT HAS BEEN CONSIDERED IMPOSSIBLE WILL MOVE TO THE POSSIBLE CATEGORY FOLLOWING RESEARCH. TECHNOLOGY AND ENGINEERING EXPERIMENTS, SUCH AS ELECTRON BEAM WELDING, THERMAL CONTROL COATING EVALUATION, TUBE JOINING, HEAT EXCHANGER SERVICE AND EXTRA-VEHICULAR ACTIVITY HARDWARE EVALUATION WILL BE CONDUCTED IN THE APOLLO APPLICATIONS PROGRAM, FOLLOW-ON TO THE APOLLO PROGRAM.

THE EXPLORATION OF SPACE HAS BEEN LIMITED IN CONCEPT AND EXTENT BY THE HIGH COST OF PUTTING A PAYLOAD INTO ORBIT, AND THE INACCESSIBILITY OF OBJECTS AFTER THEY HAVE BEEN LAUNCHED. TODAY WE HAVE IN SIGHT THE TECHNOLOGY NECESSARY FOR REUSABLE SPACE VEHICLES. THIS KNOWLEDGE TOGETHER WITH THE NEED OF THE UPCOMING SPACE STATIONS LEAD ME TO FORECAST THAT THE NEXT MAJOR THRUST IN SPACE WILL BE THE DEVELOPMENT OF AN ECONOMICAL SPACE VEHICLE FOR SHUTTLING BETWEEN EARTH AND THE INSTALLATIONS, SUCH AS ORBITING SPACE STATIONS WHICH WILL BE OPERATING IN SPACE.

UNTIL NOW IT HAS BEEN ESSENTIAL TO OPTIMIZE SPACE TRANSPORTATION SYSTEMS ON THE BASIS OF PERFORMANCE. ONLY

A DECADE AGO, TECHNOLOGY WAS PUSHED TO ITS LIMITS IN ORDER TO BARELY ACHIEVE ORBITAL FLIGHT. OUR FIRST VANGUARDS AND EXPLORERS COST IN THE ORDER OF A THIRD OF A MILLION DOLLARS PER POUND OF PAYLOAD TO FLY INTO SPACE. A SPACE SHUTTLE SHOULD EVOLVE INTO A SYSTEM WHICH CAN DELIVER USABLE PAYLOAD AT A COST APPROACHING \$5 PER POUND.

IDEALLY, THE 'SPACE SHUTTLE' WOULD BE ABLE TO OPERATE IN A MODE SIMILAR TO THAT OF LARGE COMMERCIAL AIR TRANSPORTS AND BE COMPATIBLE WITH THE ENVIRONMENT OF MAJOR AIRPORTS.

IT WOULD TAKE OFF VERTICALLY FROM A SMALL PAD AT AN AIRBASE OR MAJOR AIRPORT, DISPATCHED BY CREWS SIMILAR IN SIZE TO THOSE REQUIRED FOR INTERCONTINENTAL JETS. UPON ITS RETURN FROM ORBIT, THE "SPACE SHUTTLE" WOULD REENTER THE ATMOSPHERE AND GLIDE TO A HORIZONTAL RUNWAY LANDING, WITH PRACTICALLY NO NOISE.

INTERESTINGLY ENOUGH, THE BASIC DESIGN FOR AN ECONOMICAL SPACE TRANSPORT COULD ALSO BE THE IMMEDIATE ANCESTOR OF AN AIRCRAFT FOR TERRESTRIAL POINT-TO-POINT TRANSPORT.

THE USE OF THE "SPACE SHUTTLE" AS A GLOBAL TRANSPORT WOULD REQUIRE THAT IT BE AS SAFE, FLEXIBLE AND ECONOMICAL AS THE THEN OPERATIONAL SYSTEMS. ESTIMATES WHICH ALREADY EXIST ANTICIPATE THAT THE TOTAL OPERATING COST OF A SPACE SHUTTLE, FLYING A NOMINAL ROUTE, (NEW YORK TO TOKYO) WOULD BE A LITTLE ABOVE TEN CENTS PER PASSENGER NAUTICAL MILE. ALTHOUGH MORE THAN SUPERSONIC COST ESTIMATES, THAT COST IS LESS THAN THE HYPERSONIC ESTIMATE EVEN NOW. THE TRIP WOULD TAKE 46 MINUTES.

OVER THE PAST SEVERAL YEARS STUDIES HAVE PROGRESSED TO THE POINT WHERE SEVERAL PROMISING DESIGNS FOR AN ECONOMICAL, RE-USABLE SPACE VEHICLE ALREADY EXIST.

NO REALLY MEANINGFUL ESTIMATE OF THE NUMBER OF "SPACE SHUTTLE" VEHICLES WHICH WILL BE REQUIRED CAN BE GIVEN AT THIS TIME, FOR THAT NUMBER IS A FUNCTION, NOT ONLY OF THE VARIOUS MISSIONS WHICH IT WILL BE CALLED UPON TO PERFORM, BUT IT IS ALSO A FUNCTION OF THE EXISTENCE OF THE MACHINE ITSELF. AFTER ALL, NO ONE NEEDED AN AIRPLANE, A COMPUTER OR A TELEPHONE BEFORE THEY EXISTED.

THE "SPACE SHUTTLE" IS ANOTHER STEP TOWARD OUR DESTINY IN SPACE AND ON THE EARTH. IN MY OPINION, IT IS THE KEY TO OUR EFFICIENT UTILIZATION OF THE CAPABILITY WE NOW HAVE AND TO THE APPLICATION OF THE KNOWLEDGE WE HAVE ALREADY GAINED.

I HAVE TRIED TO SUMMARIZE IN A FEW MINUTES WHAT IS IMMEDIATELY AHEAD IN MANNED SPACE FLIGHT ACTIVITIES AND TO INDICATE WHAT I BELIEVE ARE SOME OF THE VAST OPPORTUNITIES OPEN TO US AS A SPACEFARING NATION. PERHAPS THE SIMPLEST, MOST ELOQUENT REASON FOR EXPLORING SPACE WAS EXPRESSED BY THE LATE DR. HUGH L. DRYDEN, DISTINGUISHED FIRST DEPUTY ADMINISTRATOR OF NASA, AND HOME SECRETARY OF THE NATIONAL ACADEMY OF SCIENCES, WHEN HE SAID:

"NONE OF US KNOWS WHAT THE FINAL DESTINY OF MAN MAY BE -- OR IF THERE IS ANY END TO HIS CAPACITY FOR GROWTH AND ADAPTION. WHEREVER THIS VENTURE LEADS US, WE IN THE

UNITED STATES ARE CONVINCED THAT THE POWER TO LEAVE THE EARTH -- TO TRAVEL WHERE WE WILL IN SPACE -- AND TO RETURN AT WILL -- MARKS THE OPENING OF A BRILLIANT NEW STAGE IN MAN'S EVOLUTION."