ANCILLARY SUPPORT ACTIVITIES

- **LUNAR AND PLANETARY SCIENCE STATION**
- **SOLAR SYSTEM OBSERVATORY**
- **BASIC PHYSICS RESEARCH CENTER**
- **FAR-SIDE RADIO AND OPTICAL OBSERVATORY**
- **TERRESTRIAL METEORLOLGY CENTER**
- **DEEP SPACE MISSION OPERATIONS CENTER**
- **ONE-SIXTH GRAVITY SPACE PHYSIOLOGY RESEARCH CENTER**
- **ONE/SIXTH GRAVITY MATERIALS RESEARCH CENTER**
- **TOURIST FACILITY**
- **ARCHIVAL FACILITY**

“CULTURAL” DESIGN CONSIDERATIONS

- **HABITAT AND INDOOR WORKING FACILITIES PERSONNEL FRIENDLY**
  - **ELECTONIC, REALTIME WINDOWS**
  - **PIPED IN NATURAL LIGHT**
  - **PRIVACY AREAS**
  - **PERSONAL GARDEN PLOTS**
  - **INDIVIDUAL AND PRIVATE VOICE AND ELECTONIC COMMUNICATIONS BACK TO EARTH**

- **PLAN ON EXTERIOR RECREATION**
  - **ADDITIONAL DEMAND ON SPACE SUIT LONGEVITY AND RELIABILITY**

- **DETERMINE LONG TERM SUITABILITY OF 1/6 GRAVITY FOR INDIVIDUALS AND FAMILIES**
  - **BIOMEDICAL RESEARCH IN LONG TERM EFFECTS**
  - **BIOMEDICAL RESEARCH IN CHILD PHYSICAL DEVELOPMENT**
  - **BIOMEDICAL RESEARCH IN TO BASIS FOR OCCUPATIONAL MEDICAL PRACTICE**
  - **RE-ADAPTATION PROTOCOL FOR RETURN TO EARTH**

- **FINANCIAL / POLITICAL INCENTIVES FOR ENTERPRISE OWNERSHIP**
  - **STOCK AND STOCK OPTIONS**
  - **GOVERNANCE REPRESENTATION**
  - **LONG TERM PLAN FOR SELF-GOVERNANCE OF SETTLEMENT**

NASA HST IMAGE

VARIOUS CLASS MISSIONS

- SPLIT/SPRINT-OPPOSITION CLASS (1988 NASA OFFICE OF EXPLORATION)
  - ROBOTIC PRECURSORS
  - ONE CARGO VEHICLE/ONE CREW VEHICLE
  - 14 MONTHS
  - 30 DAYS IN ORBIT
  - 20 DAYS ON SURFACE
  - 4 CREW ON SURFACE / 4 IN ORBIT
  - 60 TOTAL HOURS OF EVAS BY 2 CREW MEMBERS
  - 3 MISSIONS

- SPLIT/SPRINT-OPPOSITION CLASS (1988 NASA JSC)
  - ROBOTIC PRECURSORS
  - ONE CARGO VEHICLE/ONE CREW VEHICLE
  - 14 MONTHS
  - 30 DAYS IN ORBIT
  - <20 DAYS ON SURFACE
  - 2 CREW ON SURFACE / 1 IN ORBIT
  - 60 TOTAL HOURS OF EVAS BY 2 CREW MEMBERS
  - 1 MISSION

- VENUS SWING-BY (COLLINS, 1988)
  - ROBOTIC PRECURSORS?
  - ONE VEHICLE
  - 22 MONTHS
  - 30 DAYS IN ORBIT?
  - 40 DAYS ON SURFACE
  - 4 CREW ON SURFACE / 4 IN ORBIT?
  - 120 TOTAL HOURS OF EVAS BY 2 CREW MEMBERS?
  - 3 MISSIONS?

- "MARS DIRECT" CONJUNCTION CLASS (ZUBRIN, 1996, NASA INTEREST, 1999)
  - ONE AUTOMATED CREW RETURN VEHICLE/ONE DELAYED CREW VEHICLE
  - 30 MONTHS
  - MANUFACTURE RETURN FUEL AND OXIDIZER PRIOR
  - TO CREW LAUNCH
  - 0 DAYS IN ORBIT
  - 18 MONTHS ON SURFACE
  - 4 CREW ON SURFACE / 0 IN ORBIT
  - REPEATED MISSIONS

MINIMUM ENERGY

- **MINIMUM ENERGY-CONJUNCTION CLASS (NEAL, ET AL., 1989)**
  - **RECONNAISSANCE FROM ORBIT / NO ROBOTIC PRECURSORS REQUIRED**
  - **ONE VEHICLE / TWO LANDERS**
  - **32 MONTHS**
  - **18 MONTHS IN ORBIT**
  - **90 TOTAL DAYS ON SURFACE**
  - **4 CREW ON SURFACE / 4 IN ORBIT ALTERNATING TO SURFACE**
  - **1200 TOTAL HOURS EVAS BY 8 CREW MEMBERS AT TWO SITES**
  - **4 MISSIONS/8 SITES WITH FIFTH MISSION THE CREATION OF A PERMANENT MARS BASE WITH 8 INITIAL INHABITANTS**

- **MAJOR POSSIBLE ENHANCEMENT OPTIONS**
  - **LAUNCH FROM THE MOON WITH LUNAR DERIVED CONSUMABLES (GREATER PAYLOAD) (SEE STANCATI, ET AL., 1991)**
  - **3HE FUSION / NUCLEAR FISSION / SOLAR ELECTRIC PROPULSION (SHORTENED TRANSIT TIME)**
  - **TRAJECTORY SHAPING (FLEXIBLE STAY TIMES AT MARS)**
  - **AEROBRAKING (MARS ORBIT INSERTION AND RETURN TO EARTH**
  - **RETURN PROPELLANT DERIVED FROM MARS ATMOSPHERE (ZUBRIN, ET AL., 1991, AND SEE STANCATI, ET AL., 1991)**

MINIMUM ENERGY

FLEXIBILITY IN TRANSIT AND ORBIT

- **LANDING DELAY DUE TO EQUIPMENT OR WEATHER PROBLEMS**
- **SURFACE EXPLORATION DELAY DUE TO EQUIPMENT, WEATHER, ADAPTATION, OR BIOLOGICAL HAZARD PROBLEMS**
- **ASCENT DELAY DUE TO EQUIPMENT PROBLEMS**
- **EARLY ASCENT DUE TO DEGRADING SYSTEMS OR A CREW HEALTH PROBLEM**
- **DESIRE EXPLORE PHOBOS AND / OR DEIMOS(?)**
- **"MISSION CONTROL" AND COMMUNICATIONS RELAY IN MARS ORBIT**
- **LANDING SITE VERIFICATIONS FROM MARS ORBIT SENSORS AND ANALYSIS**

- **OTHER ISSUES**
  - **IN-ROUTE, IN-ORBIT, ON-SURFACE SIMULATION AND TRAINING REQUIRED**
  - **MISSION RELEVANT AND VALUABLE SCIENTIFIC ACTIVITIES IN-ROUTE**
  - **MISSION MONITORING AND NON-TIME CRITICAL DATA PROCESSING ON EARTH**
  - **HIGH RATE DATA TRANSMISSION MARS-EARTH-MARS**

- **PROBLEMS**
  - **MASS COST TO SUPPORT CREW OF 8 (COULD REDUCE TO 4 AND ONE LANDING WITH INCREASE OVERALL RISK)**

SPACE BIOMEDICAL ISSUES IN MICROGRAVITY

- **MAJOR KNOWN PROBLEMS**
  - **MUSCLE ATROPHY** → **COUNTER-MEASURE OPTIONS**
    - **HEART**
    - **SUPPORT**
  - **BONE AND OTOLITH DE-MINERALIZATION** →
    - **EXERCISE**
    - **CENTRIFUGAL FORCE**
    - **DRUG THERAPY**
  - **RATE OF RE-ADAPTATION TO GRAVITY ENVIRONMENT** →
    - **EXERCISE IN GRAVITY**
  - **IMMUNE SYSTEM COMPROMISE (?)** → **ALL OF THE ABOVE**
  - **RADIATION PROTECTION** →

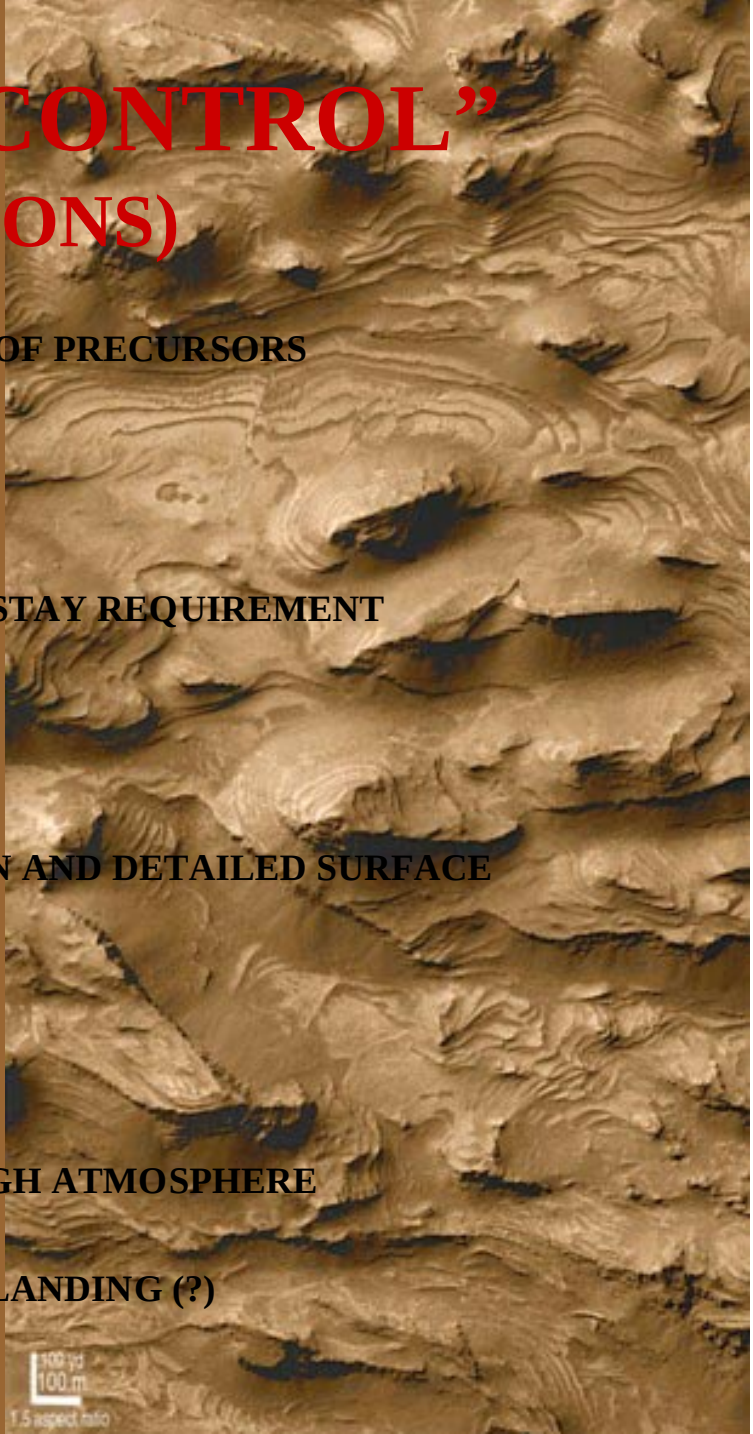
IN-TRANSIT AND IN ORBIT
"WATER" SURROUNDED STORM CELLER

ON-SURFACE
"REGOLITH" COVER FOR ZENITH

NOTE: NO SCIENTIFICALLY CREDITABLE UNDERSTANDING OF THESE PROBLEMS AND OPTIONS HAS BEEN DEVELOPED TO DATE DUE TO THE LACK OF A SYSTEMATIC RESEARCH PROTOCOL AND USE OF INAPPROPRIATE TEST SUBJECTS. NASA HAS ONLY HAD 40 YEARS, FOR CRYING OUT LOUD!

ORBITAL "MISSION CONTROL" (FIRST FEW MISSIONS)

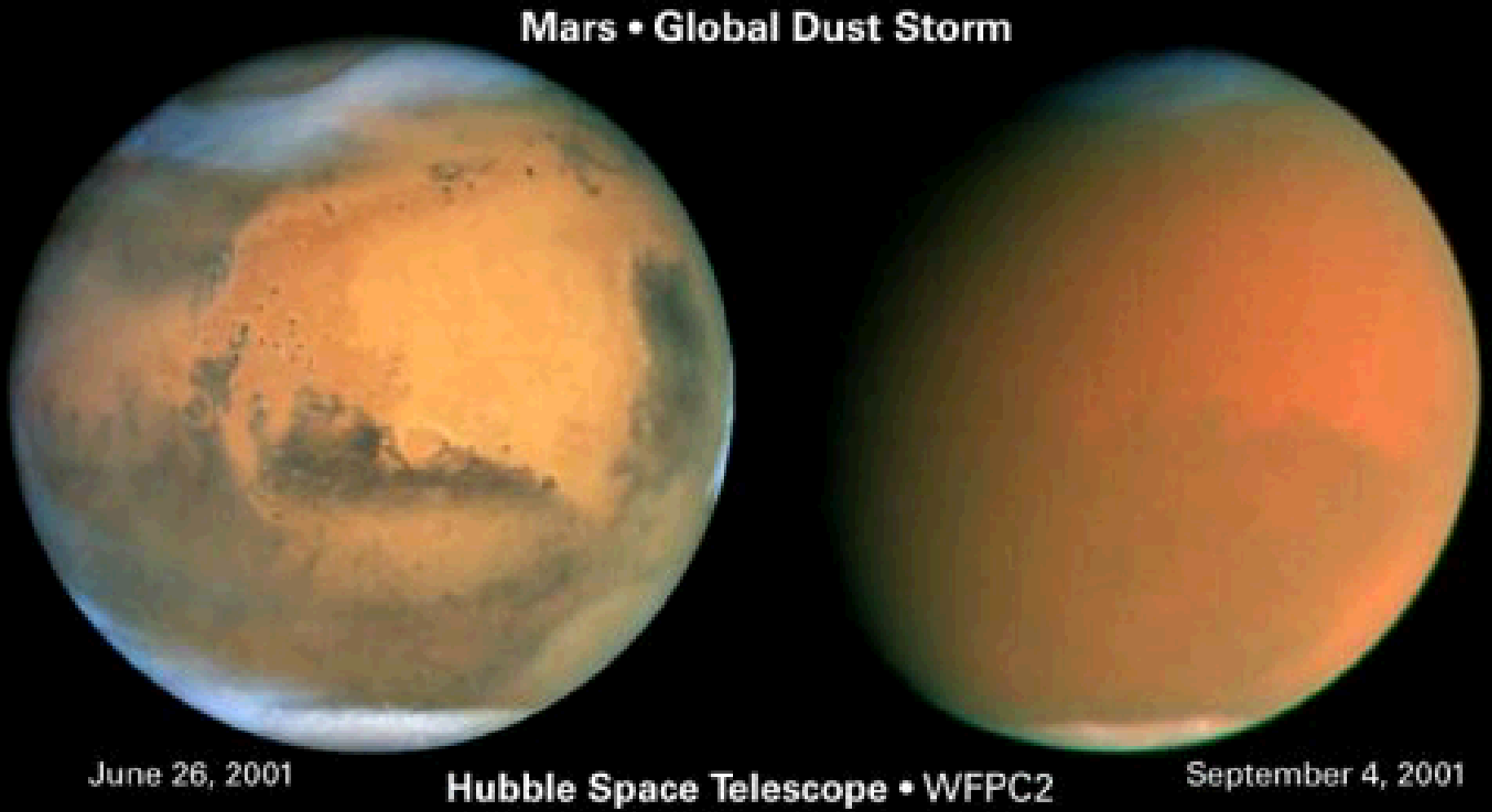
- OVERALL SUCCESS NOT DEPENDENT ON SUCCESS OF PRECURSORS
- COMMUNICATIONS DELAY OF 8-40 MINUTES PUTS EARTH "OUT OF THE LOOP"
- TAKE ADVANTAGE OF CONJUCTION CLASS MARS-STAY REQUIREMENT
  - 16 MONTHS IN ORBIT
- PROVIDES CURRENT ENVIRONMENTAL DATA AND HUMAN COGNITIVE ANALYSIS ON THE SPOT
  - LANDING SITE SELECTION AND VERIFICATION AND DETAILED SURFACE MISSION PLANNING
  - SPECTRAL DATA
  - RADAR DATA
  - SURFACE PROBES
  - LANDING BEACON DEPLOYMENT
  - LANDING TRAJECTORY PRECURSORS THROUGH ATMOSPHERE
  - DATA FUSION SOFTWARE
  - SAMPLE RETURN TO ORBIT VS. TESTS AFTER LANDING (?)
  - REFINE LANDER PAYLOAD



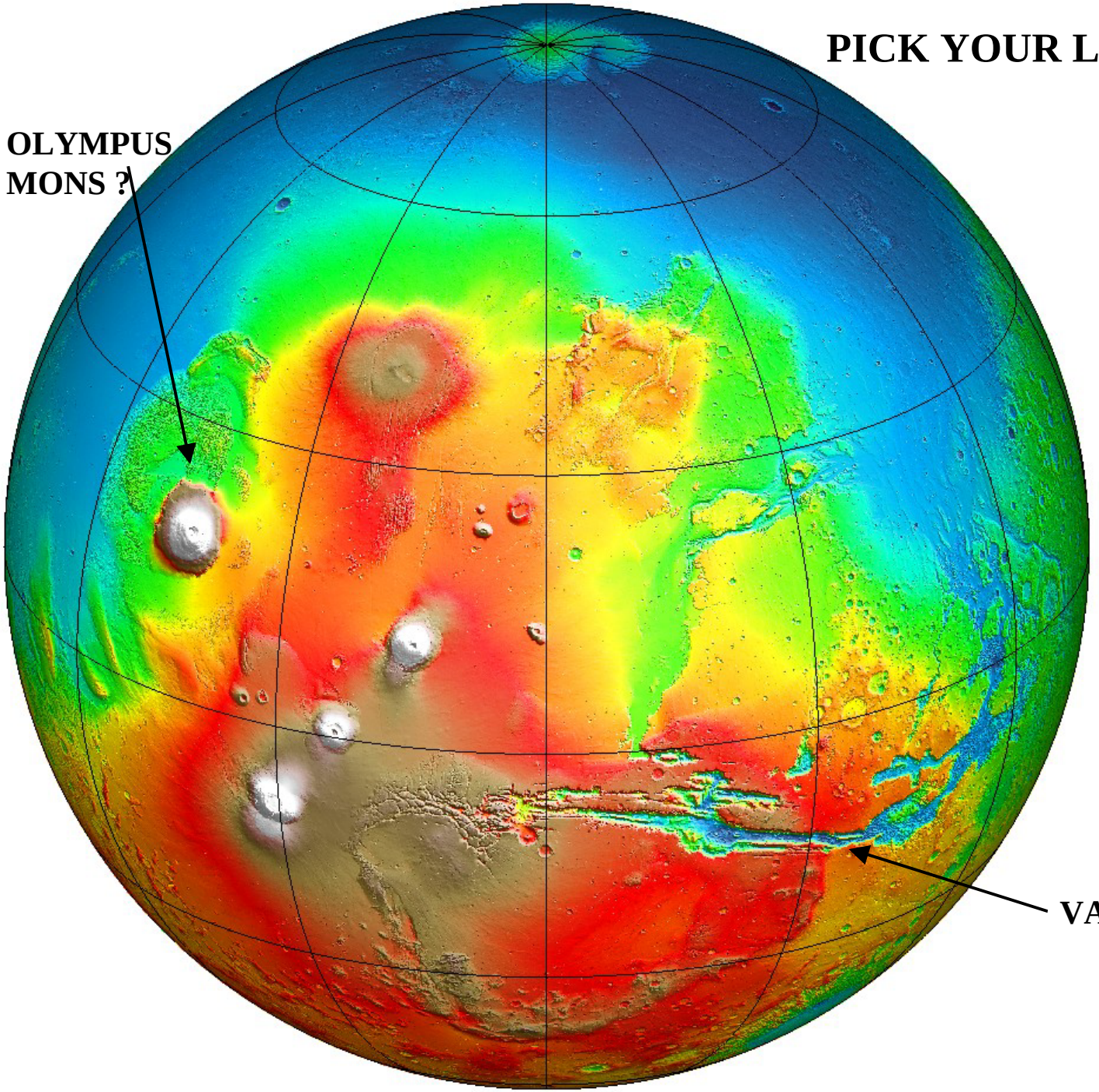
ORBITAL "MISSION CONTROL" -2
(FIRST FEW MISSIONS)

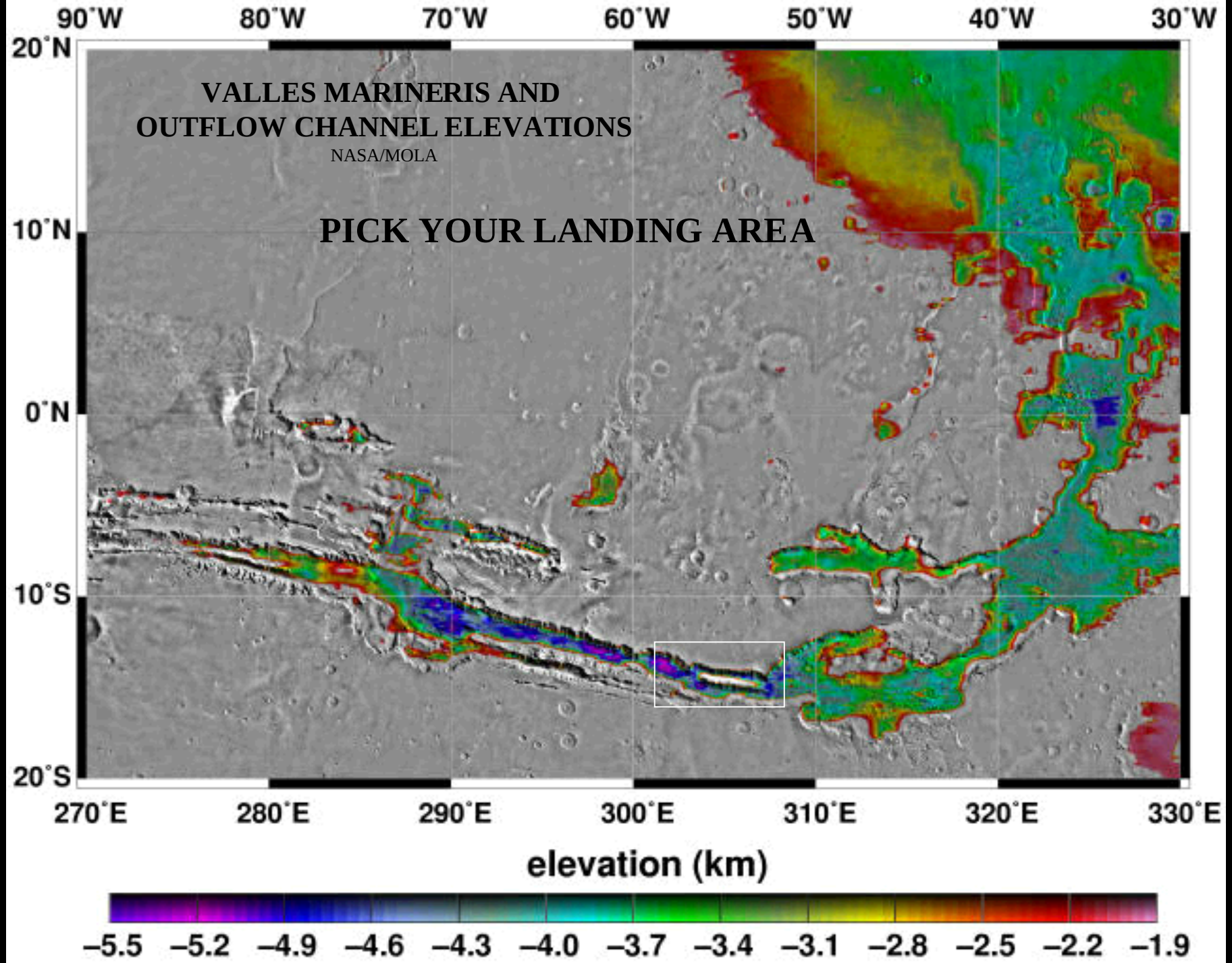
- BUILD ON MARINER, VIKING, PATHFINDER, AND MARS SURVEYOR DATA BASE
- USE EARTH DATA PROCESSING AND CONSULTATION
- MARS ENVIRONMENT AND SURFACE BETTER CHARACTERIZED THAN BEFORE APOLLO 11
  - EXCEPT FOR POTENTIAL PATHOGENS IN ISOLATED ECOSYSTEMS
- LANDING SYSTEMS MONITORING
- LANDER-EARTH DATA RELAY AS REQUIRED
- EVA PLANNING ASSISTANCE
- PHOBOS-DEIMOS EXPLORATION (SEE NEAL, ET AL, 1989)

IMAGINE, YOU ARRIVE IN MARS ORBIT AND
THIS IS WHAT HAS HAPPENED SINCE LEAVING EARTH!

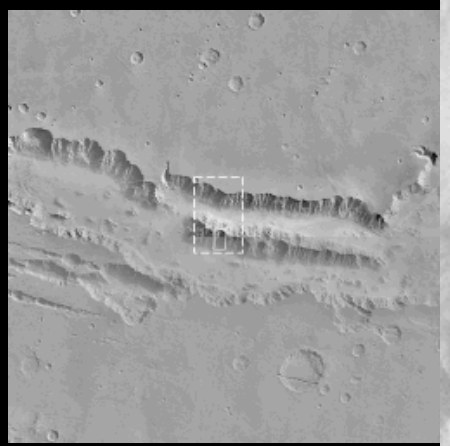


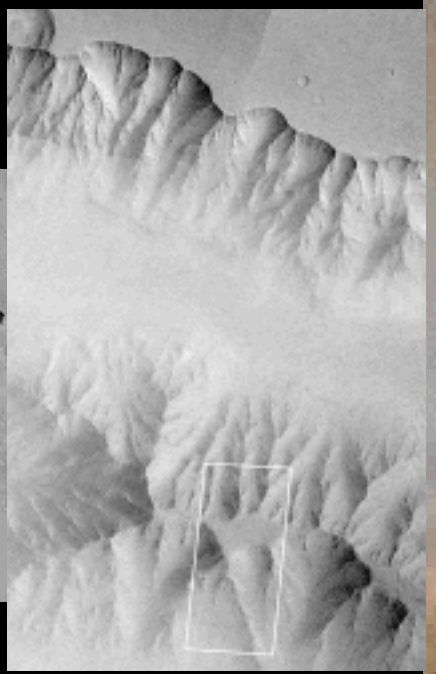
PICK YOUR LANDING REGION




VALLES MARINERIS AND
OUTFLOW CHANNEL ELEVATIONS
NASA/MOLA
PICK YOUR LANDING AREA
90˚W
80˚W
70˚W
60˚W
50˚W
40˚W
30˚W
20˚N
10˚N
0˚N
10˚S
20˚S
270˚E
280˚E
290˚E
300˚E
310˚E
320˚E
330˚E
elevation (km)
–5.5 –5.2 –4.9 –4.6 –4.3 –4.0 –3.7 –3.4 –3.1 –2.8 –2.5 –2.2 –1.9

...VALLES MARINERIS MAY PRESENT AN EXCITING APPROACH, LANDING, AND EXPLORATION TARGET!





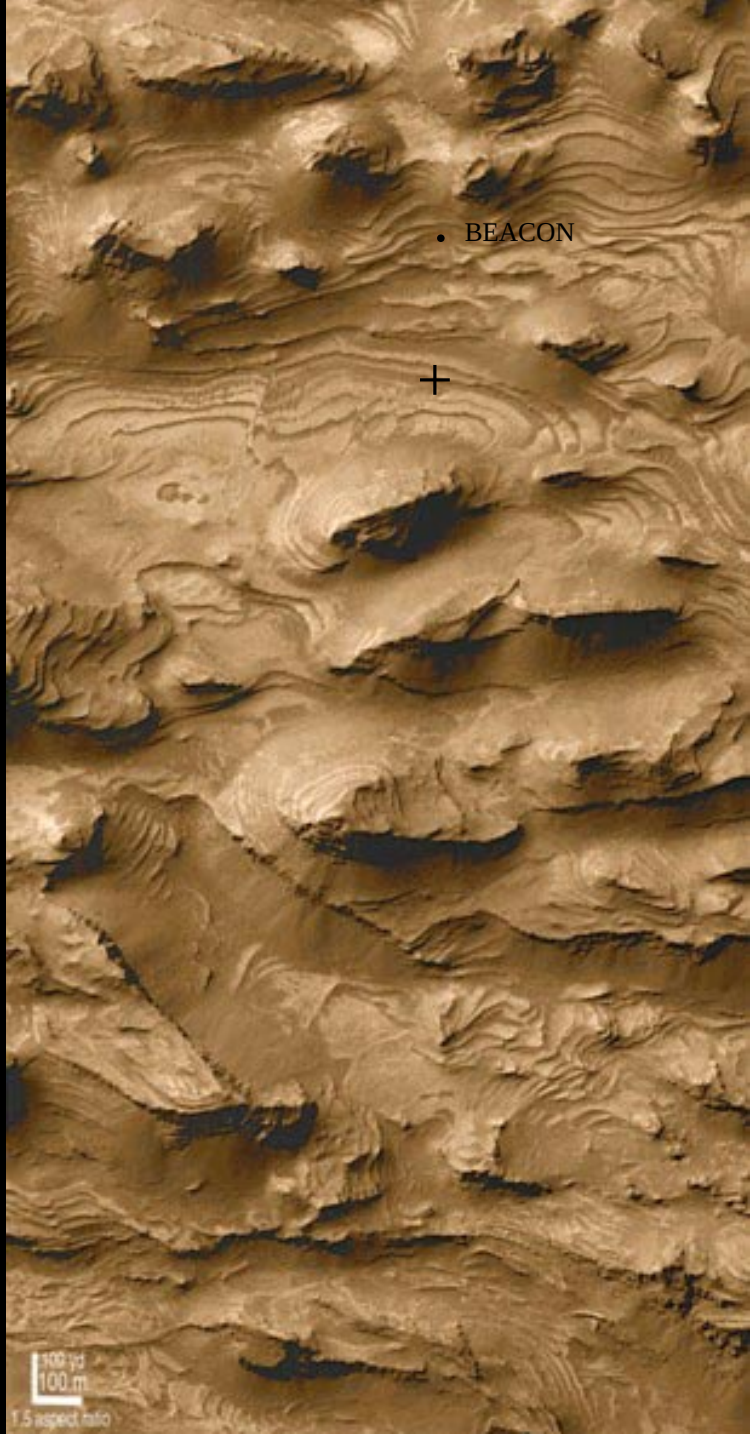
PICK YOUR LANDING SITE

BEACON

NASA/JPL/MALIN SPACE SCIENCE SYSTEMS.

WITH A LANDING AMONG THE LAYERS AND FOSSILS (?) OF CANDOR CHASMA

100 METERS OR A LITTLE LESS THAN A SATURN V OR A LITTLE MORE THAN A FOOTBALL FIELD

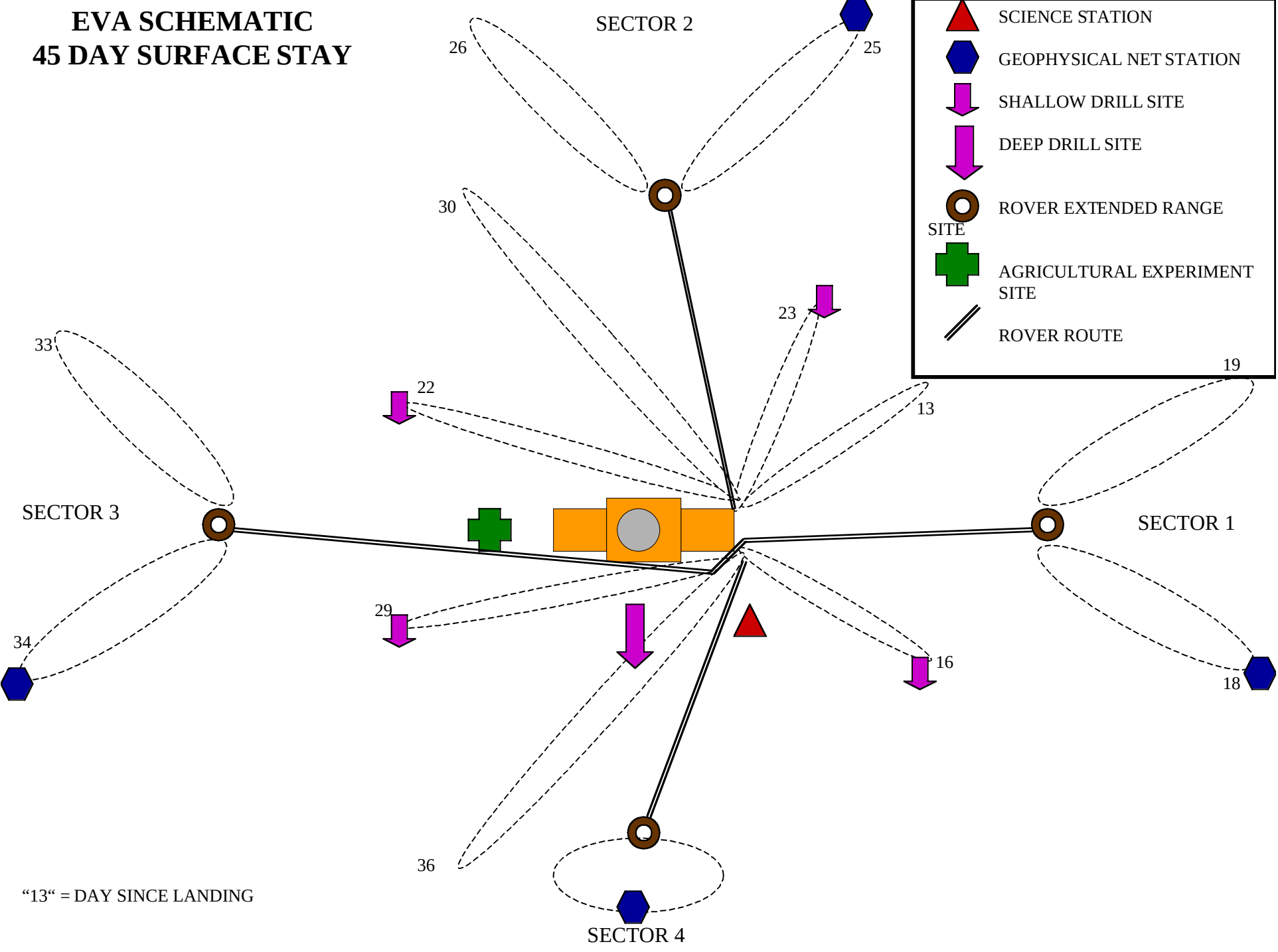


NASA/JPL/MALIN SPACE SCIENCE SYSTEMS

A POSSIBLE REPRESENTATIVE VIEW FROM THE "MARTIAN MODULE"
BEFORE THE FIRST EVA, HOWEVER….
VALLES MARINERIS WILL BE A TAD MORE SPECTACULAR

NASA/JPL/PATHFINDER

EVA SCHEMATIC
45 DAY SURFACE STAY



"13" = DAY SINCE LANDING

HUMAN MISSIOIN FOR MARS BASE SITE EVALUATION

- WEEK ONE (DAYS 1-6)
  - READAPTATION
  - ENVIRONMENTAL TESTS
  - ACTIVATION OF EXTERIOR SENSORS
  - PHYSICAL MONITORING
  - PLANNING
- WEEK TWO (DAYS 8-13)
  - SHORT/SIMPLE PROXIMITY EVAS
  - DEPLOY COMM ANTENNA / SCIENCE STATION / AGRICULTURAL TEST STATION
  - START DEEP DRILL SYSTEM
  - SELECTED SAMPLE ANALYSIS
  - PHYSICAL MONITORING
  - PLANNING SESSIONS
- WEEK THREE (DAYS 15-20)
  - SECTOR 1 EXPLORATION
  - MID LENGTH EVAS USING ROVER
  - EXTENDED RANGE EVA WITH TWO ROVERS
  - SHALLOW DRILLING/DEPLOY GEO. NET
  - SELECTED SAMPLE ANALYSIS
  - PHYSICAL MONITORING
  - PLANNING SESSIONS
- WEEK FOUR (DAYS 22-27
  - SECTOR 2 EXPLORATION
  - DITTO WEEK THREE
- WEEK FIVE (DAYS 29-34)
  - SECTOR 3 EXPLORATION
  - DITTO WEEK THREE
- WEEK SIX (DAYS 36-41)
  - SECTOR 4 EXPLORATION
  - ASCENT SIMULATIONS
  - DITTO WEEK THREE
- WEEK SEVEN (DAYS 43-45)
  - MOTHBALL FACILITY
  - PREPARE ROVER FOR REMOTE OPERATION
  - FINAL ASCENT SIMULATIONS
  - SAMPLE SELECTION AND STORAGE

- NOTE: ONE REST DAY PER WEEK
  - FOUR PERSON CREW
  - TWO PERSON EVAS, ALTERNATE BETWEEN PAIRS

EARLY LANDINGS STRATEGY GOAL: PERMANENT BASE

- **FIRST AND SECOND MISSIONS (POSSIBLE FOUR LANDINGS)**
  - **GENERAL EXPLORATION AND RECONNAISSANCE**
    - **AUTOMATED ROVER AFTER CREW DEPARTURE**
  - **DEVELOPMENT OF CRITERIA FOR BASE SELECTION**
  - **POTENTIAL TO ACCELERATE DECISION ON BASE SITE SELECTION**
    - **CORRELATION OF ORBITAL RECONNAISSANCE WITH DATA FROM SURFACE**
- **THIRD AND FOURTH MISSIONS (POSSIBLE FOUR LANDINGS)**
  - **EXAMINATION OF CANDIDATE BASE SITES**
    - **AUTOMATED ROVER AFTER CREW DEPARTURE**
  - **USE FOURTH LANDING TO SET UP CONSUMABLES PLANT AT SELECTED BASE SITE**
  - **GENERAL EXPLORATION AND RECONNAISSANCE**

CURRENT SCHEDULE FOR MARS - 1 (REVISED AND TO BE REVISED)

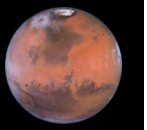
- APRIL 2001 — NASA
  - MARS ODYSSEYORBITER
    - MINERAL ANALYSIS / RADIATION
- MAY 2003 — NASA
  - ROVERS
    - SURFACE GEOLOGY/WATER
- JUNE 2003 — ESA
  - MARS EXPRESS ORBITER
  - BEAGLE 2 LANDER
    - ATMOSPHERE / SURFACE REMOTE SENSING
    - SURFACE SCIENCE / ASTROBIOLOGY
- DECEMBER 2003 — ISAS
  - ARRIVAL OF NOZOMI (ALREADY ON THE WAY)
    - UPPER ATMOSPHERE
- JULY 2005 — NASA
  - RECONNAISSANCE ORBITER
    - IMAGING/MAPPING

NASA HST IMAGE

CURRENT SCHEDULE FOR MARS - 2 (REVISED AND TO BE REVISED)

- LATE 2007 — NASA
  - SMART LANDER/ROVER
    - SURFACE SCIENCE/SAMPLE RETURN TECHNOLOGY DEMO
- LATE 2007 — CNES (FRANCE)
  - ORBITER
    - REMOTE SENSING/NETLANDERS RELAY/ SAMPLE RETURN TECHNOLOGY DEMO
- LATE 2007 — CNES (FRANCE)
  - NETLANDERS
    - ATMOSPHERE/SEISMIC SOUNDING
- LATE 2007 — ASI (ITALY)
  - TELEMARS ORBITER
    - COMMUNICATIONS
- LATE 2009 — NASA/ASI
  - ORBITER
    - POSSIBLE RADAR MAPPER
- 2011-2016 — ALL OF THE ABOVE
  - SAMPLE RETURN

NASA HST IMAGE



IF A LUNAR HELIUM-3 INITIATIVE BEGAN BY 2005 WITH ASSURED FUNDING, THE FIRST HUMAN MISSION TO MARS COULD BE LAUNCHED BY 2015, LARGELY USING TECHNOLOGY PAID FOR BY THE HELIUM-3 INITIATIVE.

HARRISON H. SCHMITT - 2001

(NOTWITHSTANDING DR. GRIFFIN'S COMMENT ABOUT "30 YEARS.")

ENJOY THE VIEW WHEN YOU GET THERE!!!!!

“TRUE COLOR OF MARS”
PATHFINDER LANDER VIEW
NASA/JPL