RETURN TO THE MOON

THIS TIME WE STAY

Second Annual Lunar Development Conference July 20-21, 2000

Artwork Created for Space Frontier Foundation by Mark Maxwell

Overview of Resources From Space Course

Topic	Number of Lectures
Origin of Elements	3
Resource Requirements (Earth & Space)	3
Space Transportation	5
Lunar Evolution & Resources	10
Mars Evolution & Resources	3
Asteroids/Comets-Threats & Resources	3
Solar Power Principles	2
Nuclear Power in Space	4
Socio-Economic Implications	6
Exams, Intro, Summary	5

Tentative Syllabus-NEEP 533/Geology 533/Astronomy 533/EMA 601 S 2004

Resources From Space*

1:20 PM, MWF

Location 265 Materials Science

Date	#		Instructor	Topic	Other
21-Jan	1	W	GLK/HHS	A Trip to the Moon/One Environmental System	
23-Jan	2	F	Brown	Resource Limitations on Earth-Minerals	
26-Jan	3	M	Kulcinski	Resource Limitations on Earth-Energy	
28-Jan	4	W	Gallagher	Origin of the Elements	
30-Jan	5	F	Santarius	Space Travel Overview	
2-Feb	6	M	Gallagher	Birth and Early Development of Solar Systems	
4-Feb	7	W	Schmitt	Early Solar System	
6-Feb	8	F	Schmitt	Evolution of the Moon as a Planet	
9-Feb	9	M	Schmitt	Evolution of the Moon as a Planet	
11-Feb	10	W	Schmitt	Potential Resources of the Moon	
13-Feb	11	F	Larry Taylor	Recent Observations of the soils on the Moon	
16-Feb	12	M	Kulcinski	Extraction Techniques-Solar Wind Volatiles	provided
18-Feb	13	W	Kulcinski	Extraction Techniques- Oxygen	
20-Feb	14	F	Kulcinski	Design of a Lunar Volatiles Miner	
23-Feb	15	M	Kulcinski	Exam	
25-Feb	16	W	Brown	Extraction Techniques for Minerals in Space	
27-Feb	17	F	Schmitt	Evolution of Mars as a Planet, Possible Life on Mars	
1-Mar	18	M	Schmitt	Evolution of Mars as a Planet, Possible Life on Mars	
3-Mar	19	W	Schmitt	Potential Resources of Mars	
5-Mar	20	F	Schmitt	Potential Resources On and From the Asteroids/Comets	
8-Mar	21	M	Kulcinski	Nuclear Power Sources in Space	
10-Mar	22	W	Kulcinski	Nuclear Power Sources in Space	
12-Mar	23	**	Schmitt	Special Topics-NASA Management and Safety-Evening-Week March 1	
3/13 to 3/21				Spring Break	
22-Mar	24	M	Kulcinski	Fusion-Principles	
24-Mar	25	W	Kulcinski	Helium-3 Fusion	Term paper topic chosen
26-Mar	26	F	Griffin	Getting There & Back-Chemical Rockets	
29-Mar	27	M	Santarius	Getting There and Back-Electric Propulsion	
31-Mar	28	W	Santarius	Getting There and Back-Fusion Rockets	
2-Apr	29	F	Santarius	Getting to an Asteroid	
5-Apr	30	M	Schmitt	Threats From Asteroids/meteorites	Term paper outline due
7-Apr	31	W	Schmitt	Lunar and Mars Base Activation Scenarios-Part I	
9-Apr	32	F	Schmitt	Lunar and Mars Base Activation Scenarios-Part II	
11-Apr		Su		Easter	
12-Apr	33	M	Kulcinski	Exam	
14-Apr	34	W	Schmitt	Legal Implications (and possible evening session)	
16-Apr	35	F	Schmitt	International Implications	
19-Apr	36	M	Kulcinski	Applications-Orbiting Solar Satellite	Term paper due
21-Apr	37	W	Kulcinski	Applications-Lunar Solar Station	
23-Apr	38	F	Schmitt	Alternate approaches to Lunar Development	
26-Apr	39	M	Schmitt	Government/Private Space Development Partnership	
28-Apr	40	W		Business of Big Projects	
30-Apr	41	F		Resources from the Outer Planets	
3-May	42	M	Schmitt	One possible approach to Commercialization-Interlune/Intermars	
5-May	43	W	Schmitt	Overall Effect of Space Resources on the Earth-Moon System	
7-May	44	F	All	Summary	
11-May		Tu		Final Exam-7:25 PM	

* Course can be accessed on the Net; http://fti.neep.wisc.edu/neep533.html

The Class Notes Will be Posted on the Following Web Site

http://fti.neep.wisc.edu/neep533.html

Locator for Resources From Space Faculty

Faculty	Office Phone	Office Location	E-mail
Harrison H. “Jack” Schmitt	263-3285	435 ERB	schmitt@engr.wisc.edu
Gerald L. Kulcinski	263-2308 263-1601	439 ERB 2620 EH	kulcinski@engr.wisc.edu
Phillip E. Brown	262-5954	365 Weeks	pbrown@geology.wisc.edu
John S. Gallagher III	263-2456	4503 Sterling	gallagher@astro.wisc.edu
John S. Santarius	263-1694	415 ERB	santarius@engr.wisc.edu
Guest Lectures			
Michael D. Griffin	703-248-3045	In-Q-Tel Corp	michael.griffin@cops.net
Larry A. Taylor	865-974-6013	U of Tennessee	lataylor@pop.utk.edu

Grading Procedure

- **1st Exam 25%**
- **2nd Exam 25%**
- **Term Paper 20%**
- **Final Exam 30%**

What Do You Think?

What is the most critical item to import to:

1) Earth-orbiting station

2) Lunar settlement

3) Earth to Mars rocket

4) Mars settlement

5) Earth

Choose from:

A) O_2

B) H_2O

C) Food

D) Construction material

E) High value metals

F) Energy

G) People

From where?

Earth, Moon, Mars, Asteroid, Indigenous

Summary of Poll Taken in Resources From Space, January 21, 2004

Location	Most Critical Import	From Where?
Earth Orbiting Station		
Lunar Settlement		
Earth to Mars Transport		
Mars Settlement		
Earth		

On January 14, 2004 President Bush Announces a New Human Exploration Initiative

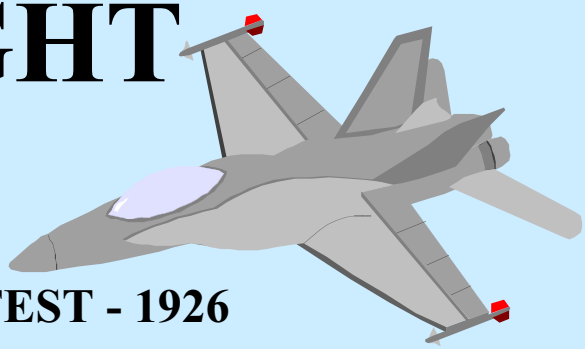
APOLLO'S LEGACY

Harrison H. Schmitt

NEEP 533

Lecture #1

MILESTONES OF FLIGHT



- WRIGHT BROTHERS FLIGHT - 1903
- WORLD WAR I - 1914
- NACA CREATED - 1915
- LINDBERGH FLIGHT - 1927
- GODDARD LFR TEST - 1926
- GERMAN A-2 FLIGHT - 1934
- DC-3 FLIGHT- 1936
- WORLD WAR II - 1939
- HE-178 (JET) FLIGHT - 1939
- YEAGER X-1 SUPERSONIC - 1947
- 707 FLIGHT - 1958
- X-15 FLIGHT - 1959
- YF-12A FLIGHT - 1962
- SPUTNIK-I - 1957
- EISENHOWER - NASA CREATED - 1958
- GARGARIN - 1961
- KENNEDY-APOLLO INITIAIVE 1961
- SATURN V FLIGHT- 1967
- BORMAN - APOLLO 8 - 1968
- ARMSTRONG - APOLLO 11 - 1969
- FIRST SCIENTIST IN SPACE/MOON -1972
- CONRAD - SKYLAB SPACE STATION - 1973
- YOUNG - SPACE SHUTTLE FLIGHT- 1980
- CONCORDE FLIGHT- 1976

APOLLO'S COLD WAR LEGACY

- COLD WAR POLITICAL GOALS OF EISENHOWER AND KENNEDY MET
- SOVIET UNION LEADERSHIP INTIMIDATED
  - REAGAN'S STRATEGIC DEFENSE LATER BECAME CREDITABLE
    - AMERICA COULD SUCCEED - SOVIETS COULD NOT
- U.S. PRIDE AND CONFIDENCE ENHANCED
- OTHER PEOPLES ENCOURAGED ABOUT THEIR FUTURE

APOLLO'S CULTURAL LEGACY

- NEW EVOLUTIONARY STATUS
  - HUMAN SPECIES CAN LIVE ON MOON AND MARS
- RAPID IMPROVEMENT IN HUMAN CONDITION ON EARTH
  - ACCELERATION OF TECHNOLOGICAL EXPANSION
- FUTURE TERRESTRIAL ENERGY AND ENVIORNMENTAL IMPROVEMENT
  - CONVERSION EFFICENCIES ENHANCED
  - LUNAR HELIUM-3 FUSION MADE POTENTIALLY FEASIBLE
- SPACE SETTLEMENT RESOURCES IDENTIFIED
  - HYDROGEN, OXYGEN, WATER, AND FOOD

APOLLO'S KEYS TO SUCCESS

- SUFFICIENT BASE OF TECHNOLOGY
  - WWII / COLD WAR / EISENHOWER DECISIONS
- RESERVOIR OF YOUNG ENGINEERS AND SKILLED WORKERS
  - 1957 "SPUTNIK" GENERATION
- PERVASIVE ENVIRONMENT OF NATIONAL UNEASE
  - CAMPAIGN OF 1960
- CATALYTIC EVENT THAT BRINGS FOCUS TO EFFORT
  - GARGARIN'S FLIGHT
- ARTICULATE, TRUSTED AND PERSUASIVE PRESIDENT
  - JOHN F. KENNEDY
- COMPETENT AND DISCIPLINED MANAGEMENT
  - POST-APOLLO 204 FIRE

DEEP SPACE OPERATIONS STILL REQUIRE THESE KEYS!

NASA'S WORST ACCCIDENTS: COMMON THREADS

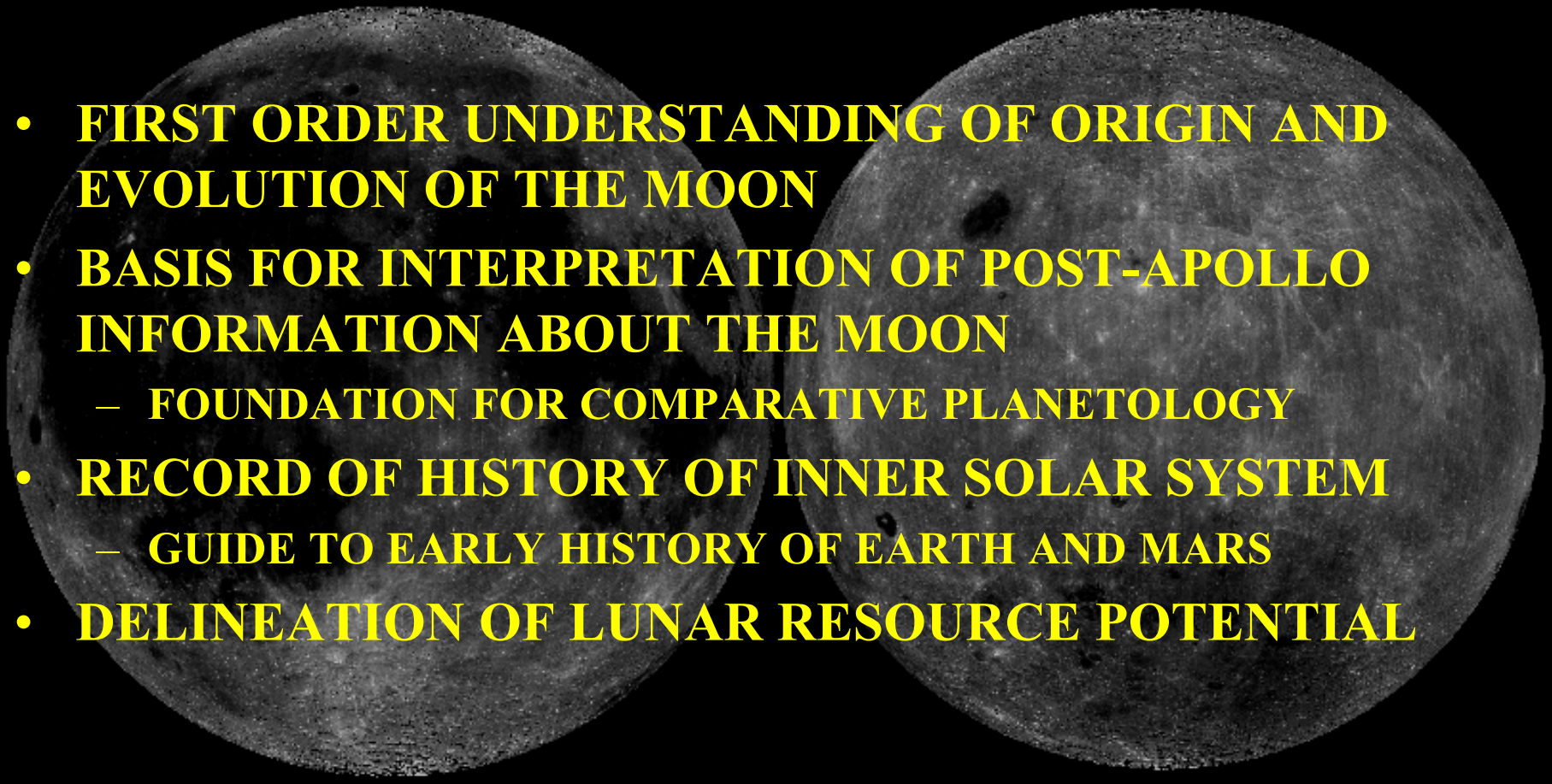
- **APOLLO 204/CHALLENGER/COLUMBIA**
  - **ACCEPTANCE OF ABNORMAL AS NORMAL**
  - **LACK OF TECHNICALLY EXPERIENCED ADMINISTRATOR**
  - **LACK OF TOP LEVEL MANAGERIAL AND OPERATIONAL OVERSIGHT**
  - **LACK OF A MECHANISM FOR APPEAL IN THE CHAIN OF MANAGEMENT**
- **ONLY WITH APOLLO 13 CAN A "PURE" SET OF ACCIDENTS BE BLAMED**

APOLLO'S KEYS TO SUCCESS: TODAY????

- SUFFICIENT BASE OF TECHNOLOGY: YES
  - WWII / COLD WAR / EISENHOWER DECISIONS
- RESERVOIR OF YOUNG ENGINEERS AND SKILLED WORKERS: YES
  - 1957 "SPUTNIK" GENERATION
- PERVASIVE ENVIRONMENT OF NATIONAL UNEASE: TERRORISM
  - CAMPAIGN OF 1960
- CATALYTIC EVENT THAT BRINGS FOCUS TO EFFORT: ??? CHINA
  - GARGARIN'S FLIGHT
- ARTICULATE, TRUSTED AND PERSUASIVE PRESIDENT: ??? BUSH
  - JOHN F. KENNEDY
- COMPETENT AND DISCIPLINED MANAGEMENT: ????????????
  - POST-APOLLO 204 FIRE

DEEP SPACE OPERATIONS STILL REQUIRE THESE KEYS!

APOLLO'S SCIENTIFIC LECACY



- FIRST ORDER UNDERSTANDING OF ORIGIN AND EVOLUTION OF THE MOON
- BASIS FOR INTERPRETATION OF POST-APOLLO INFORMATION ABOUT THE MOON
  - FOUNDATION FOR COMPARATIVE PLANETOLOGY
- RECORD OF HISTORY OF INNER SOLAR SYSTEM
  - GUIDE TO EARLY HISTORY OF EARTH AND MARS
- DELINEATION OF LUNAR RESOURCE POTENTIAL

NOT TOO SHABBY!