

# **RICE & APOLLO DUST MEASUREMENTS**

**doi:10.1016/pss.2011.04.016**

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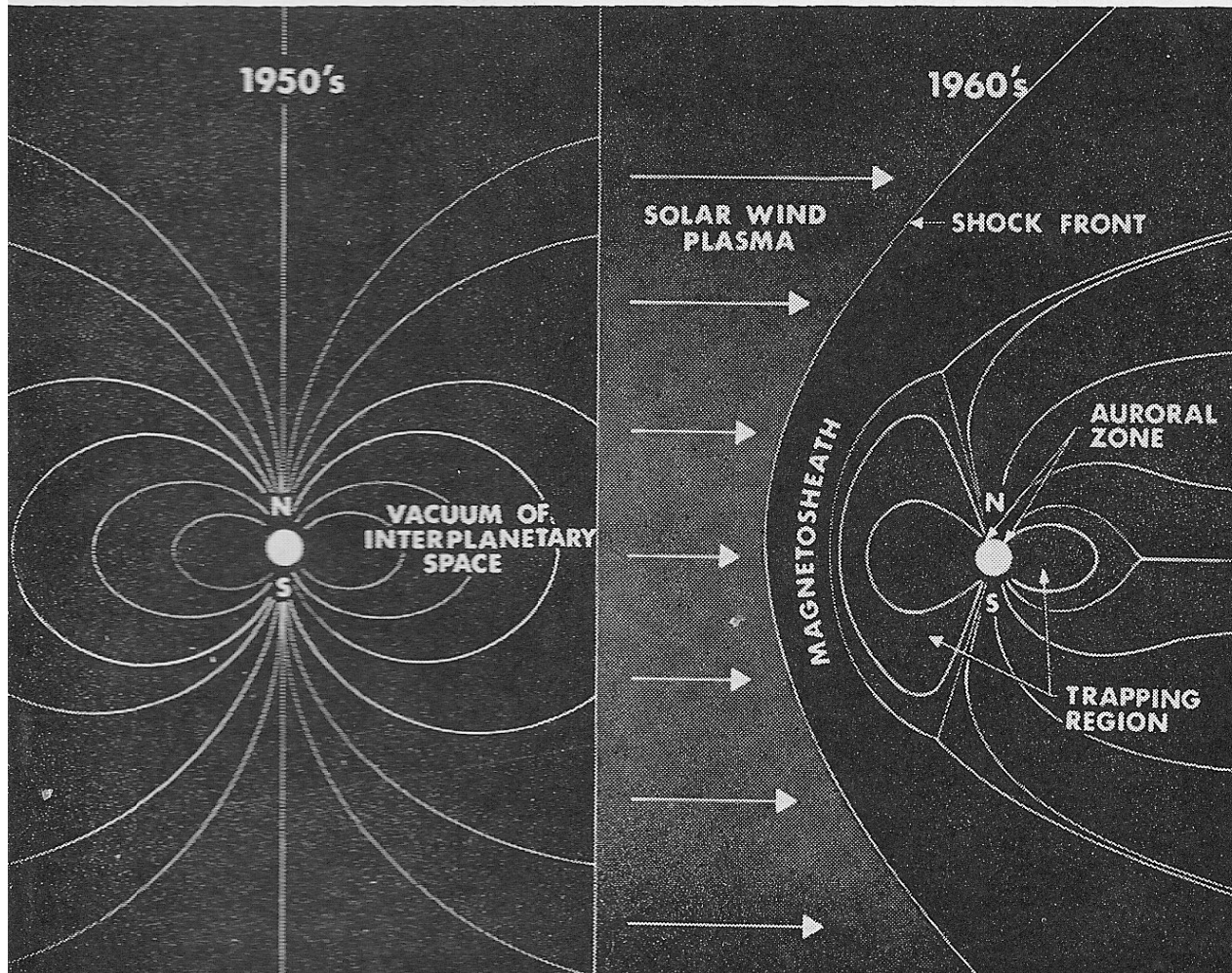
**brianjobrien@ozemail.com.au**

**School of Physics, University of W.A.**

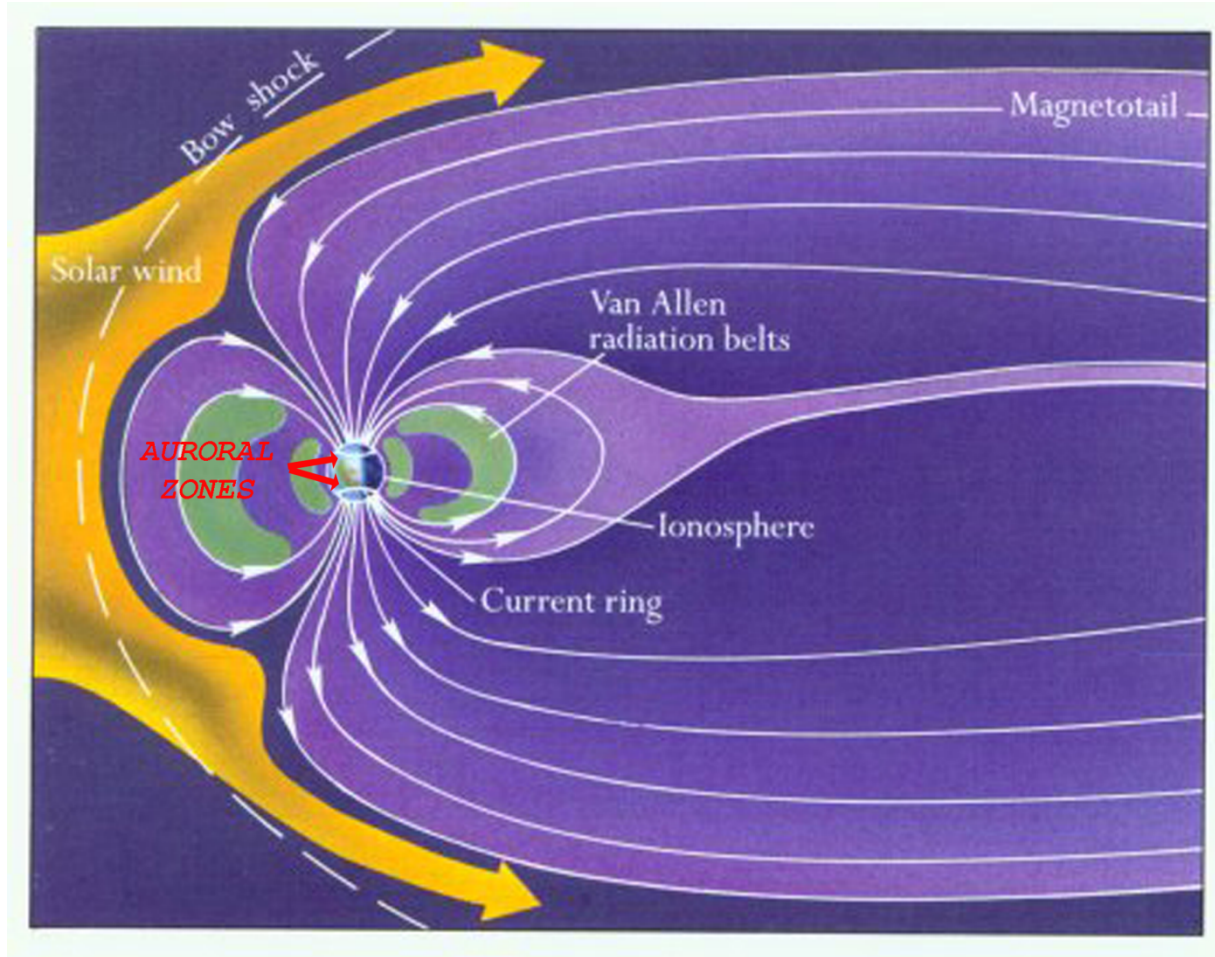
**Rice University,**

**Houston, Texas, 25 July, 2011**

# HISTORICAL PERSPECTIVE IN 1960s



# EARTH'S MAGNETOSPHERE



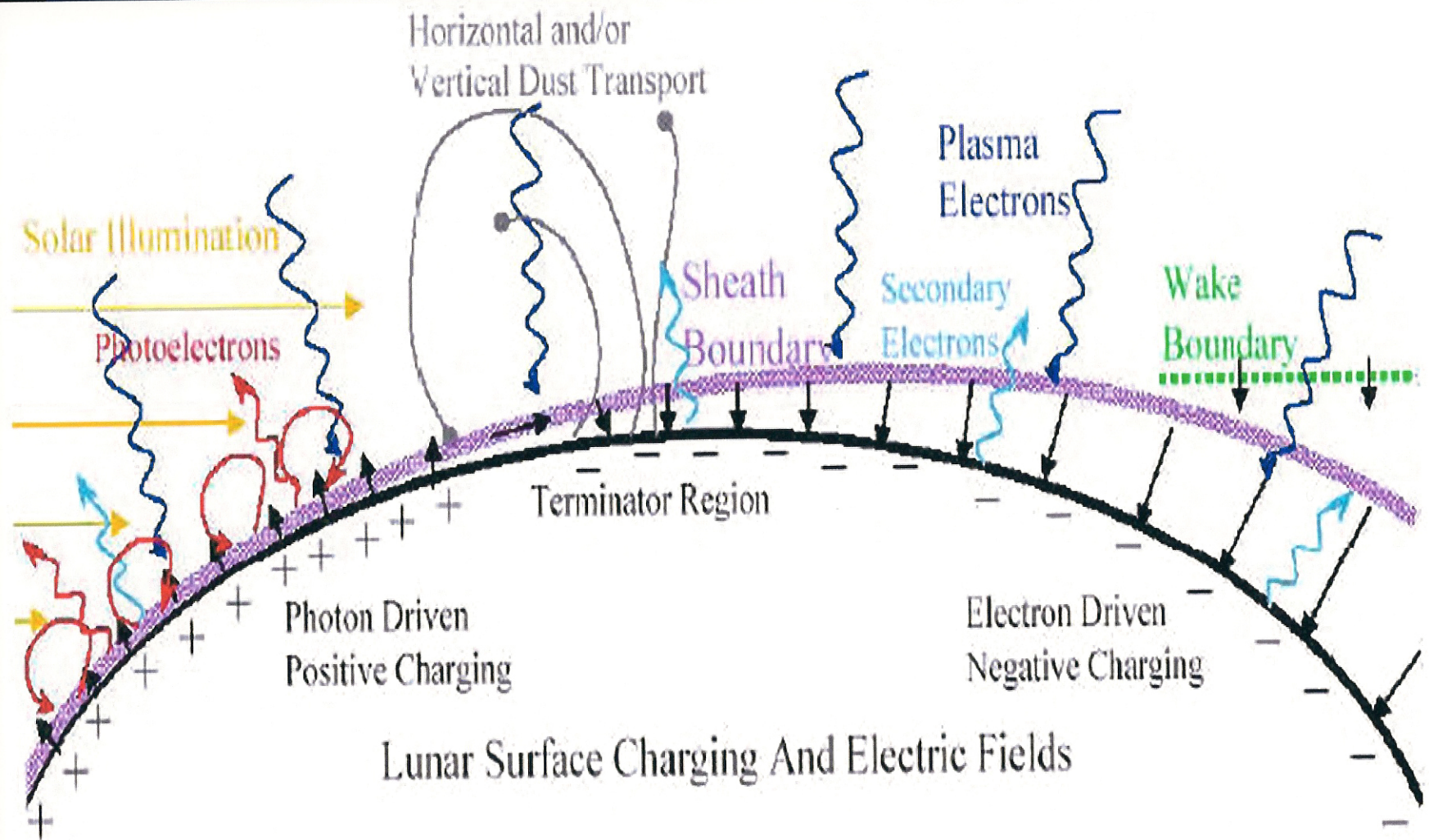
# **1966: “BORING” INERT MOON**

**CONVENIENT USEFUL NEAREST PLATFORM FOR  
SCIENCE OBSERVATORIES FREE FROM  
EARTHLY PROBLEMS**

- THICKNESS OF LUNAR DUST UNKNOWN**
- CHARGED PARTICLE ENVIRONMENTS WERE  
SIMPLY CHALLENGING EXTENSIONS OF “USUAL”  
MAGNETOSPHERE & SOLAR WIND AND LINKS  
WITH LUNAR DUST WERE IGNORED**



# Lunar Electrostatic Environment

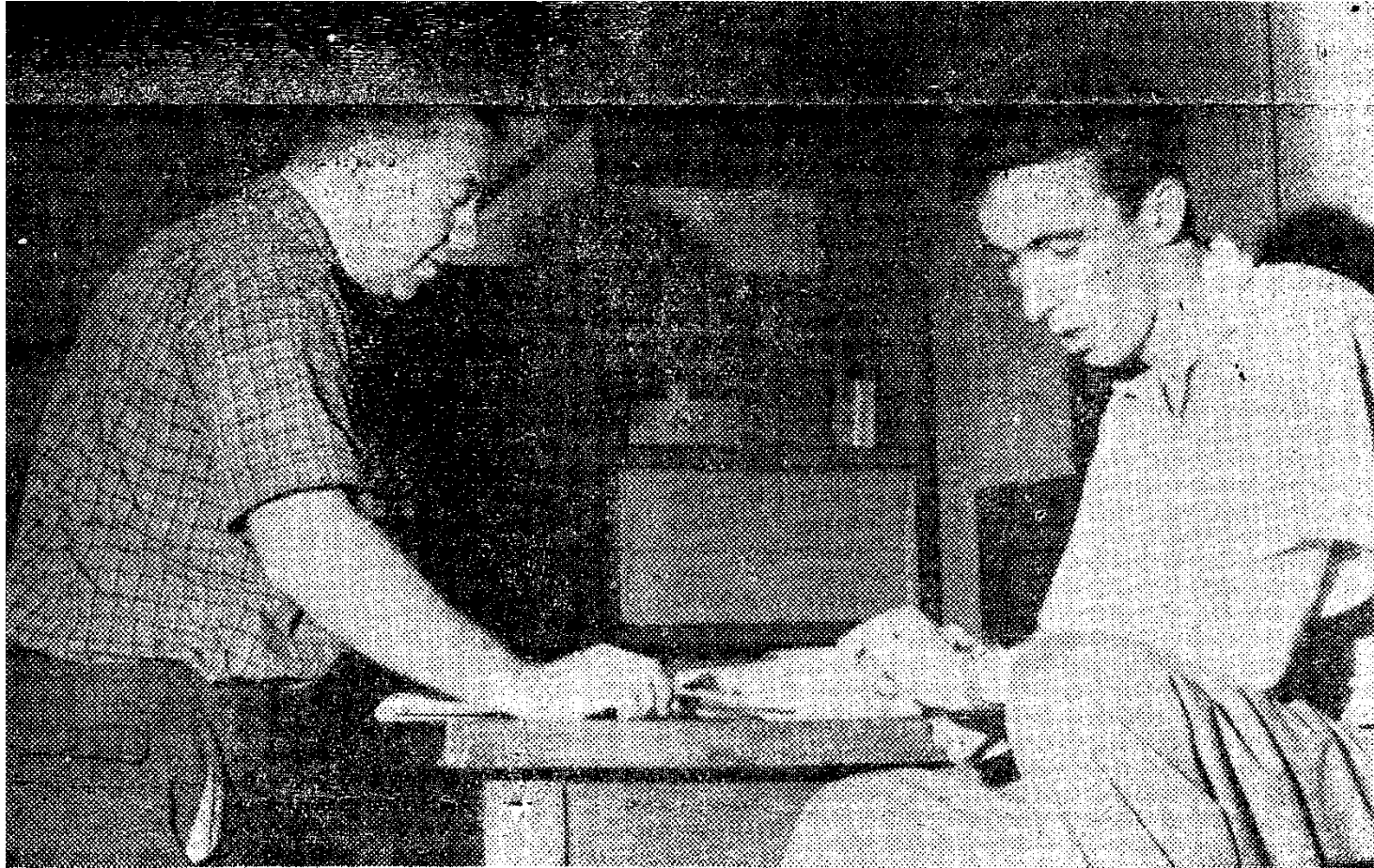


From, Stubbs et al., 2006

**2011: MOON HAS “DUSTY  
PLASMAS”, WILDLY CHANGING  
DUST ITSELF IS FASCINATING, MYSTERIOUS &  
AND DANGEROUS;  
DUST IS NOW THOUGHT TO BE AN ACTIVE KEY  
PARTICIPANT IN COMPLEX & DYNAMICALLY  
CHANGING PLASMA ENVIRONMENTS.  
THEORIES ARGUABLY BASED ON CURRENT  
BELIEF LEAM MEASURED LUNAR DUST-  
O’BRIEN SUGGESTS IT WAS “NOISE BITS”**



# VAN ALLEN & O'BRIEN 1961



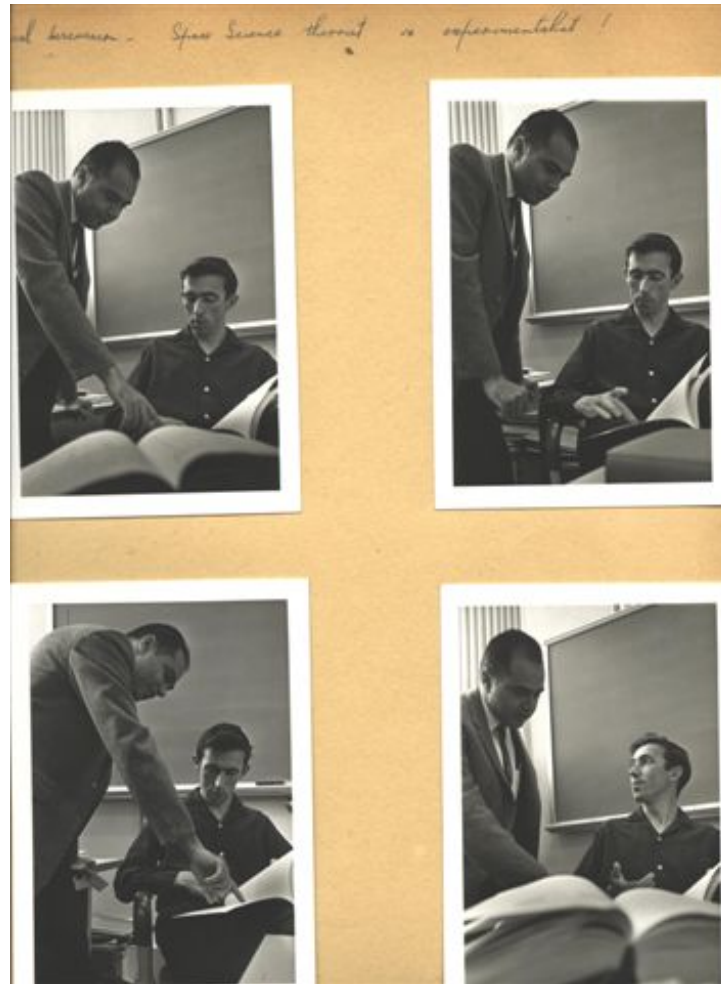
*Tracking the 'Injun'*

# **VAN ALLEN & O'BRIEN 2004 (VAN'S 90<sup>TH</sup> BIRTHDAY PRESENT)**





# RICE 1963: THEORIST versus REALIST



# "APOLLO" ASTRONAUT CLASS 1964



TO DR B.J. O'BRIEN— YOUR KNOWLEDGE OF THE UPPER ATMOSPHERE  
THAT YOU SHARED WITH THE 14 OF US WILL BE ONE OF OUR  
MOST VALUABLE TOOLS IN THE EXPLORATION OF NEAR SPACE.

ASTRONAUT CLASS OF 1964 HOUSTON



# Lunar Surface Ex Reference C



This Bendix Aerospace Lunar Surface Exploration Ref  
a number of experiments devised by the scientific commun  
to determine the composition of the Earth's natural satellit

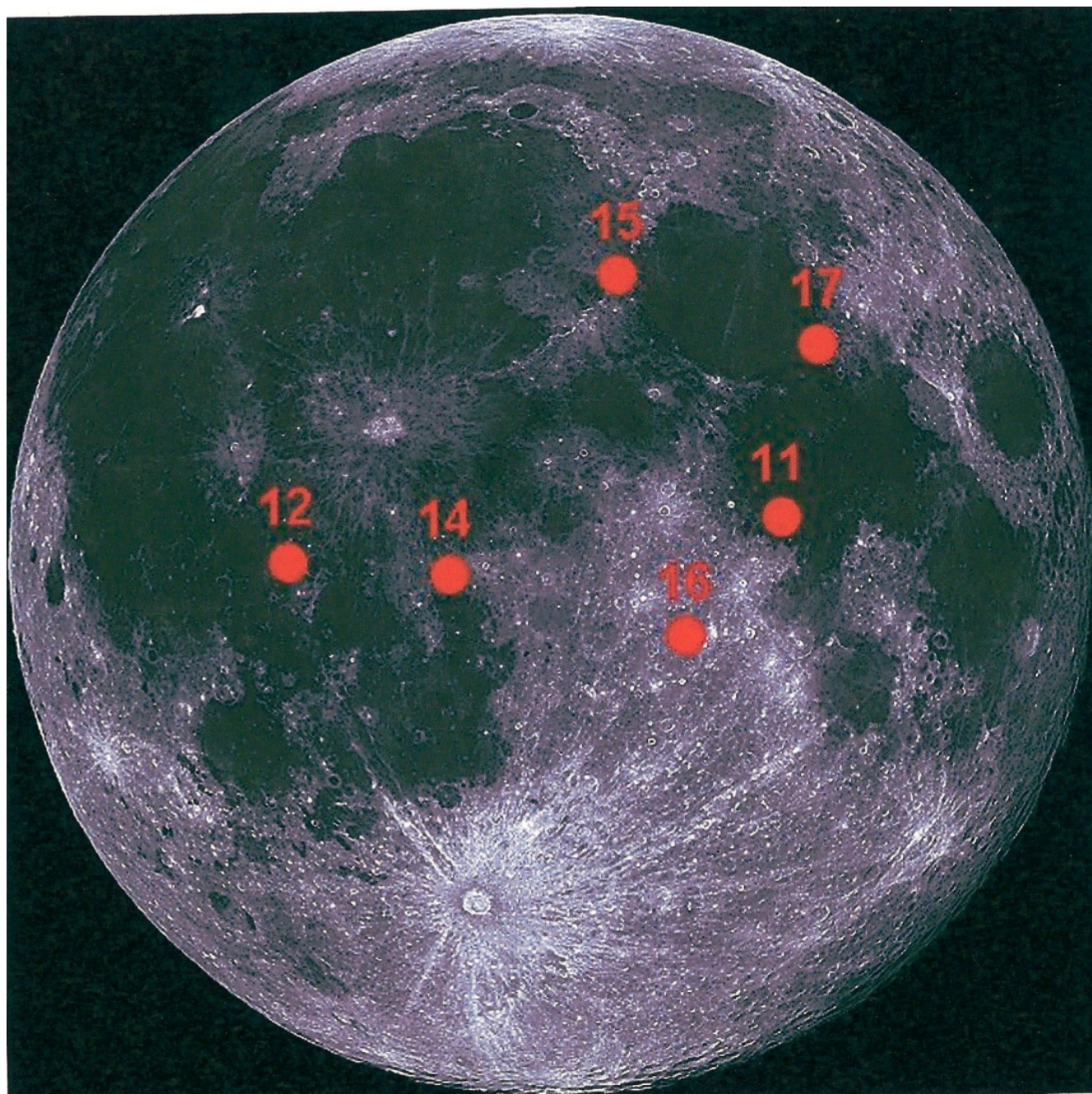


## Barbell Carry

The astronaut carries the ALSEP subpackages in barbell fashion to the deployment site 300 feet from the Lunar Module (LM). The barbell design permits the astronaut a clear field of vision, so that he will not make a mis-step. The deployment site is far enough from the LM so that the experiments will not be damaged by the LM blastoff but still within the range capability of the astronauts' space suits.

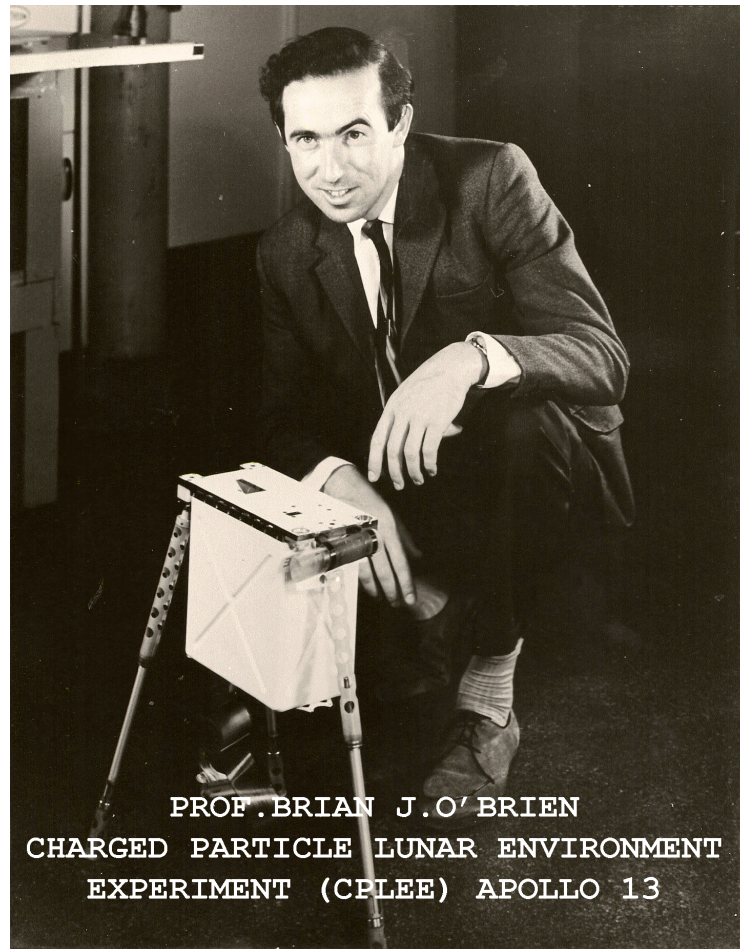






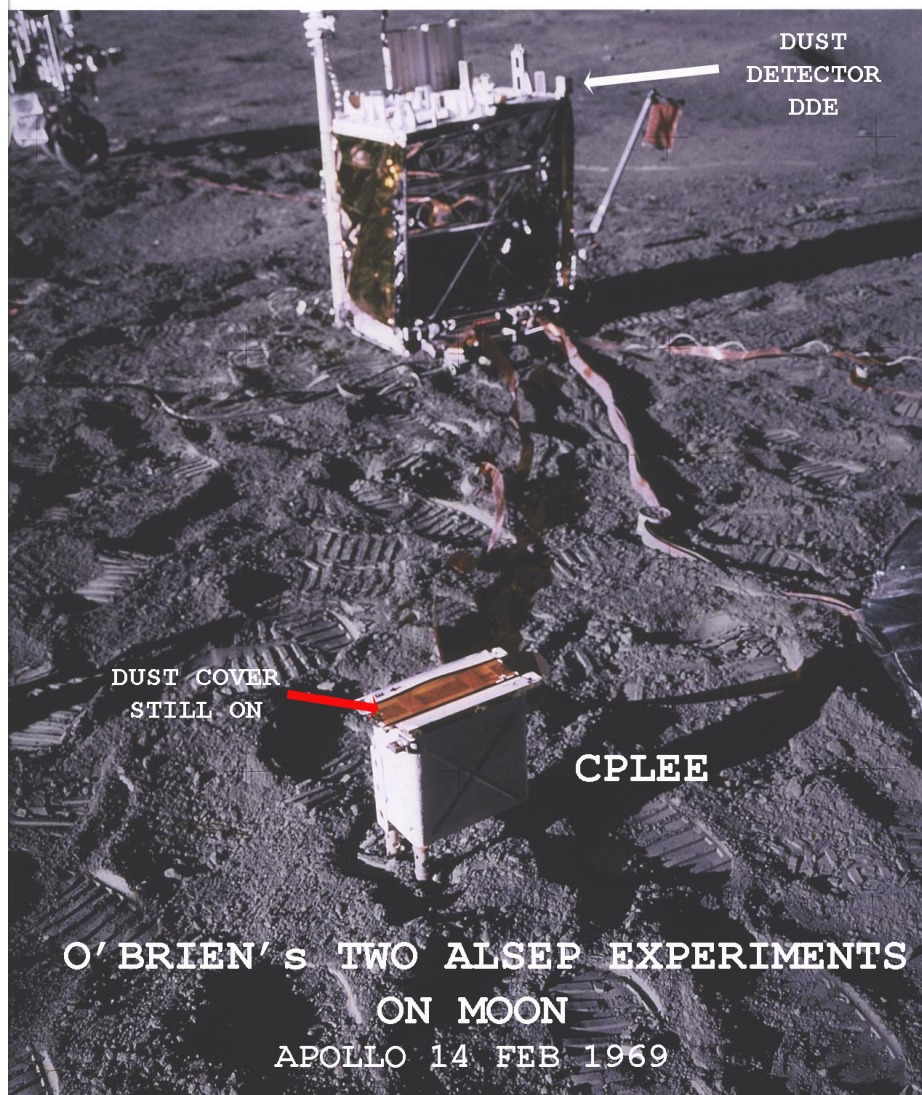


# O'BRIEN & APOLLO 13 CPLEE



PROF. BRIAN J. O'BRIEN  
CHARGED PARTICLE LUNAR ENVIRONMENT  
EXPERIMENT (CPLEE) APOLLO 13

# CPLEE & DUST DETECTOR ON MOON FEB 1971



**Q. WHY BOTHER WITH  
OLD APOLLO DUST DATA?**

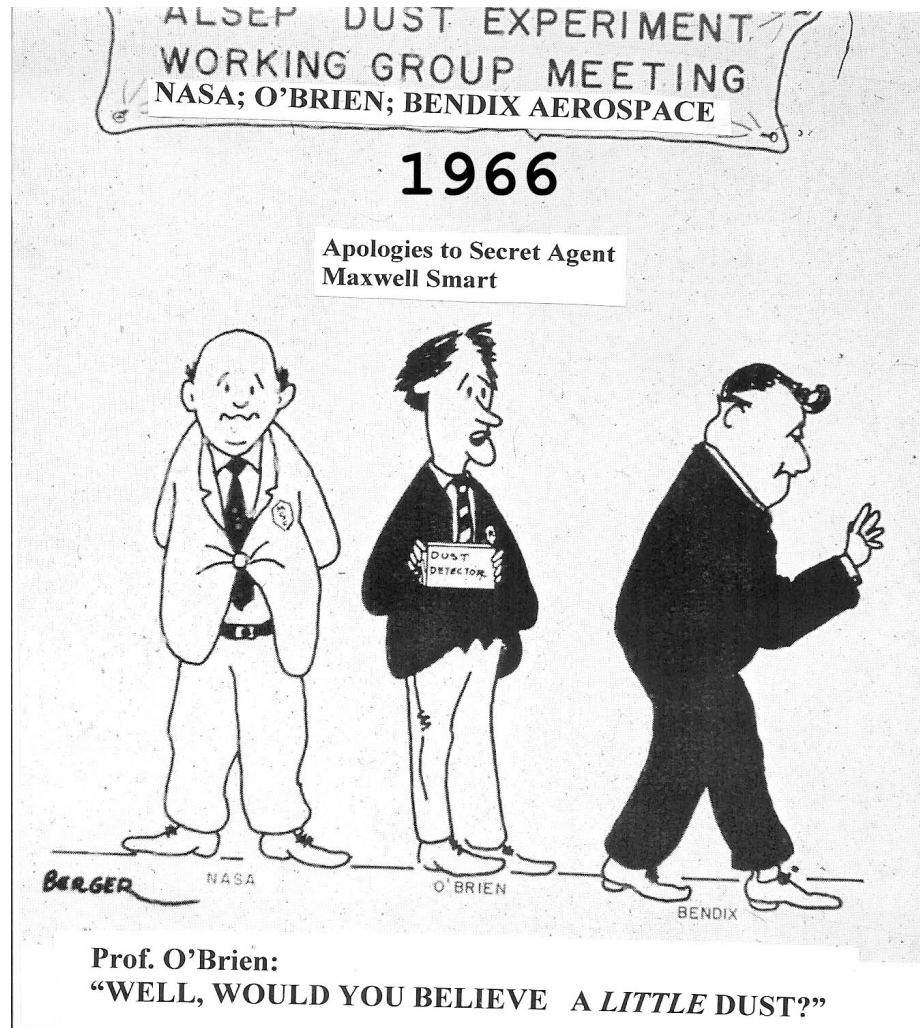
**A. BECAUSE THEY ARE STILL THE  
ONLY DIRECT BASIC DUST DATA  
FROM THE MOON SURFACE,  
THE ONLY IN SITU DUST DATA**

# APOLLO “TABOO” ABOUT DUST

- NASA & AEROSPACE ACCEPTED DUST COVERS
- **BUT** NO PLANS TO MEASURE DUST EFFECTS, EVEN ON APOLLO 11
- DUST WAS “TABOO”, KUMUNYTJAYI
  - SPACE SCIENCE BOARD REPORT AUGUST 1969
  - NASA APOLLO 17 PRELIM. SCIENCE REPORT 1973
- PERSISTS IN 2011 NASA DDE WEBSITES
- CULTURAL PROBLEM ENGINEERS/SCIENTISTS

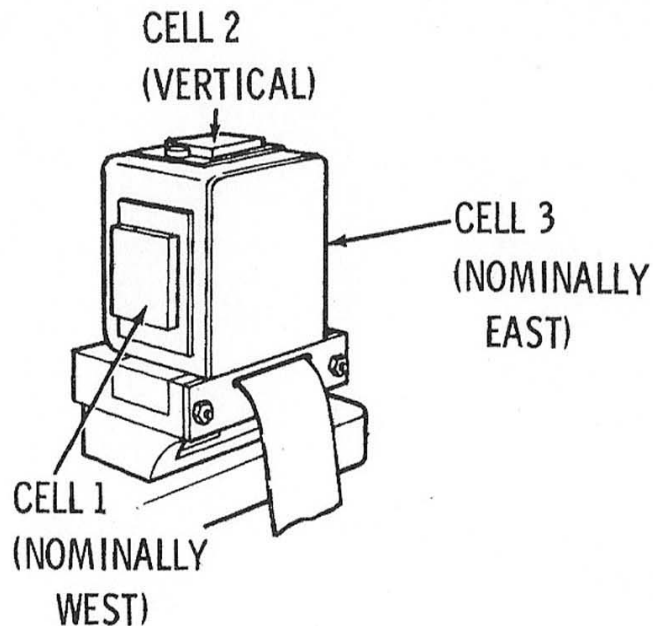


# PI O'BRIEN aka MAXWELL SMART



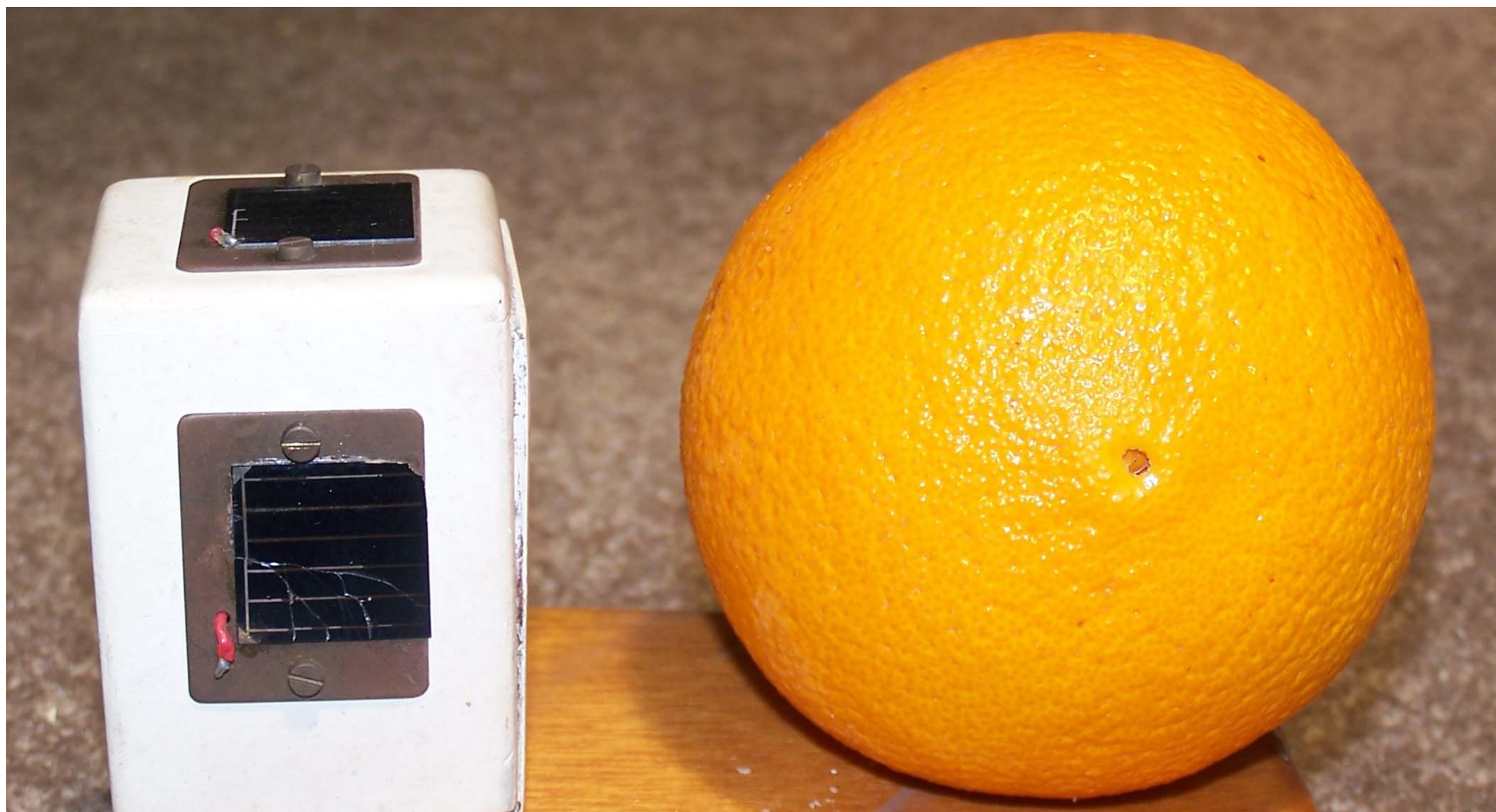
# APOLLO 12 & 13 DUST DETECTOR

## DUST DETECTOR



- TO ASSESS DUST ACCRETION ON ALSEP & INFER DEGRADATION OF THERMAL SURFACES
- USES THREE 2 CM X 2 CM PHOTOCELLS, EACH HAVING:
  - BLUE FILTER TO CUT OFF UV BELOW 0.4 MICRONS
  - 0.060-IN. FUSED SILICA RADIATION PROTECTION
  - THERMISTOR ON REAR TO MONITOR TEMP

ALSEP FAMILIARIZATION COURSE HANDOUT  
15 January 1969  
BENDIX AEROSPACE SYSTEMS DIVISION

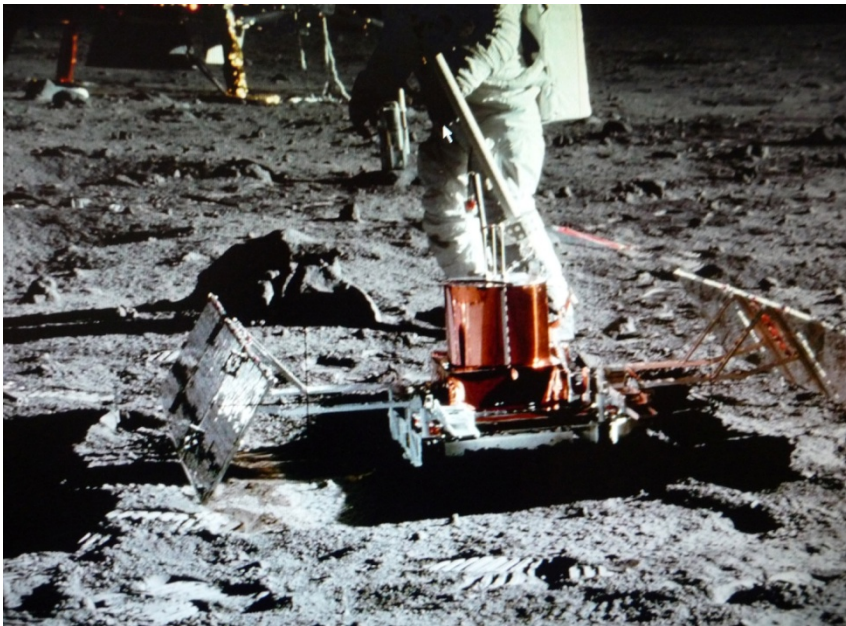




# DUST ON THE MOON: BASIC REALITIES & IMPORTANCE

**BUZZ & BIG ROCK AS SHIELD**

**“DUST IS #1 ENVIRONMENTAL  
PROBLEM ON THE MOON”**

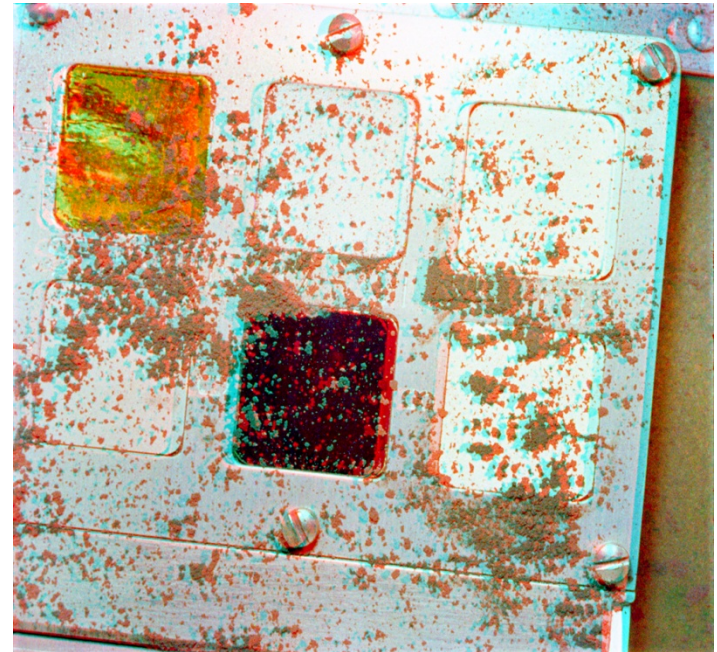
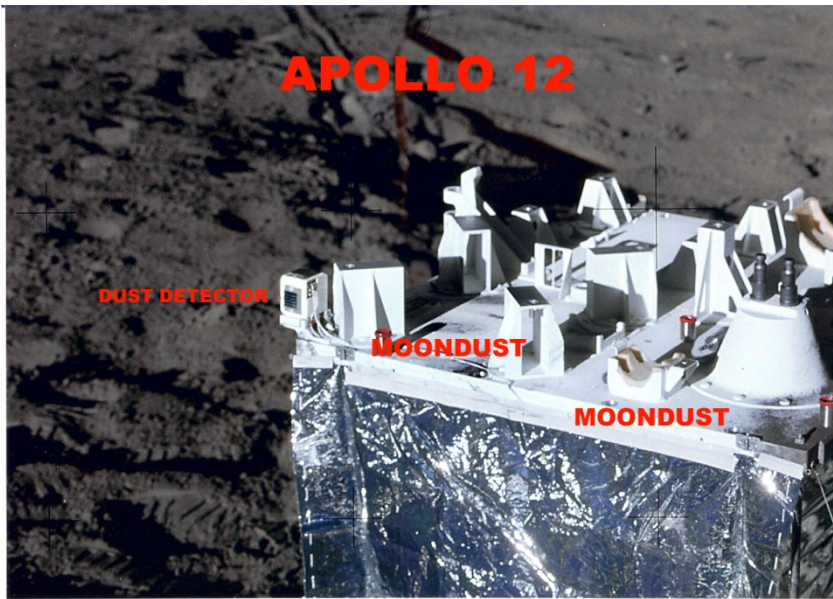




# **YET** **ONLY TWO APOLLO DUST** **EXPERIMENTS PLANNED** **& IGNORED**

**DUST DETECTORS**  
**APOLLO 11, 12, 14, 15**

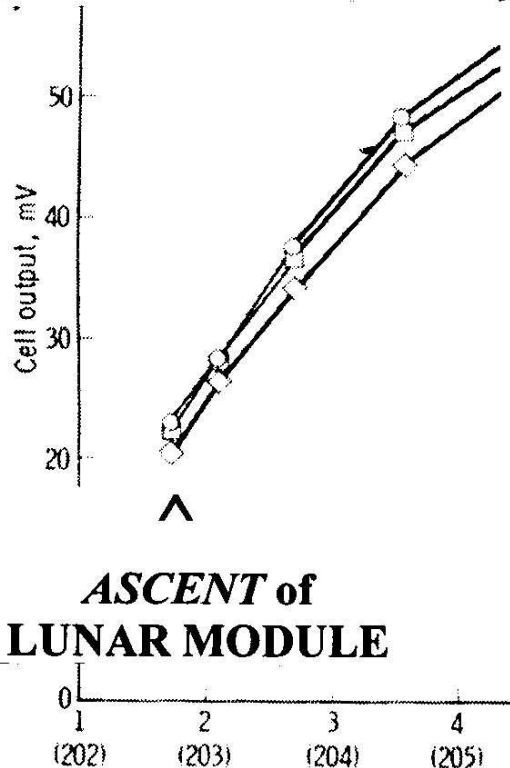
**THERMAL DEGRADATION**  
**SAMPLES TDS APOLLO 14**



# OFFICIAL NASA REPORT SP-214

## 1 DATUM POINT PER 10 HOURS

**APOLLO 11  
DUST DETECTOR**  
Daily Plots of 3 Solar Cells  
(Source: NASA Report SP-214)



**ASCENT of  
LUNAR MODULE**

**DAYS**

(Day 202 is 21 July 1969)

**NASA REPORT SP-214**  
(Apollo 11 Preliminary Science Report)

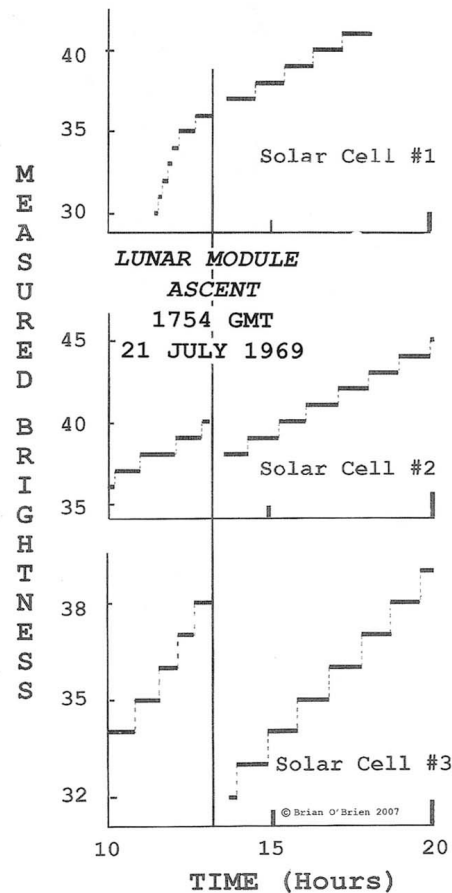
**Page 100:** “The ...dust detector ...showed no signs of degradation from the lunar soil ... blown away during the (Lunar Module) ascent.”

**Page 200:** “A preliminary analysis of (Dust Detector) data ...showed no appreciable cell degradation caused by dust or debris from the LM ascent.”  
(see daily plots, Figure 10-3 in NASA SP-214).

# O'BRIEN'S REPORT Aug 14, 1969

## 1 DATUM POINT PER 54 SECS.

### LUNAR MODULE ASCENT APOLLO 11 DUST DETECTOR



# APOLLO 12 DUST DETECTOR

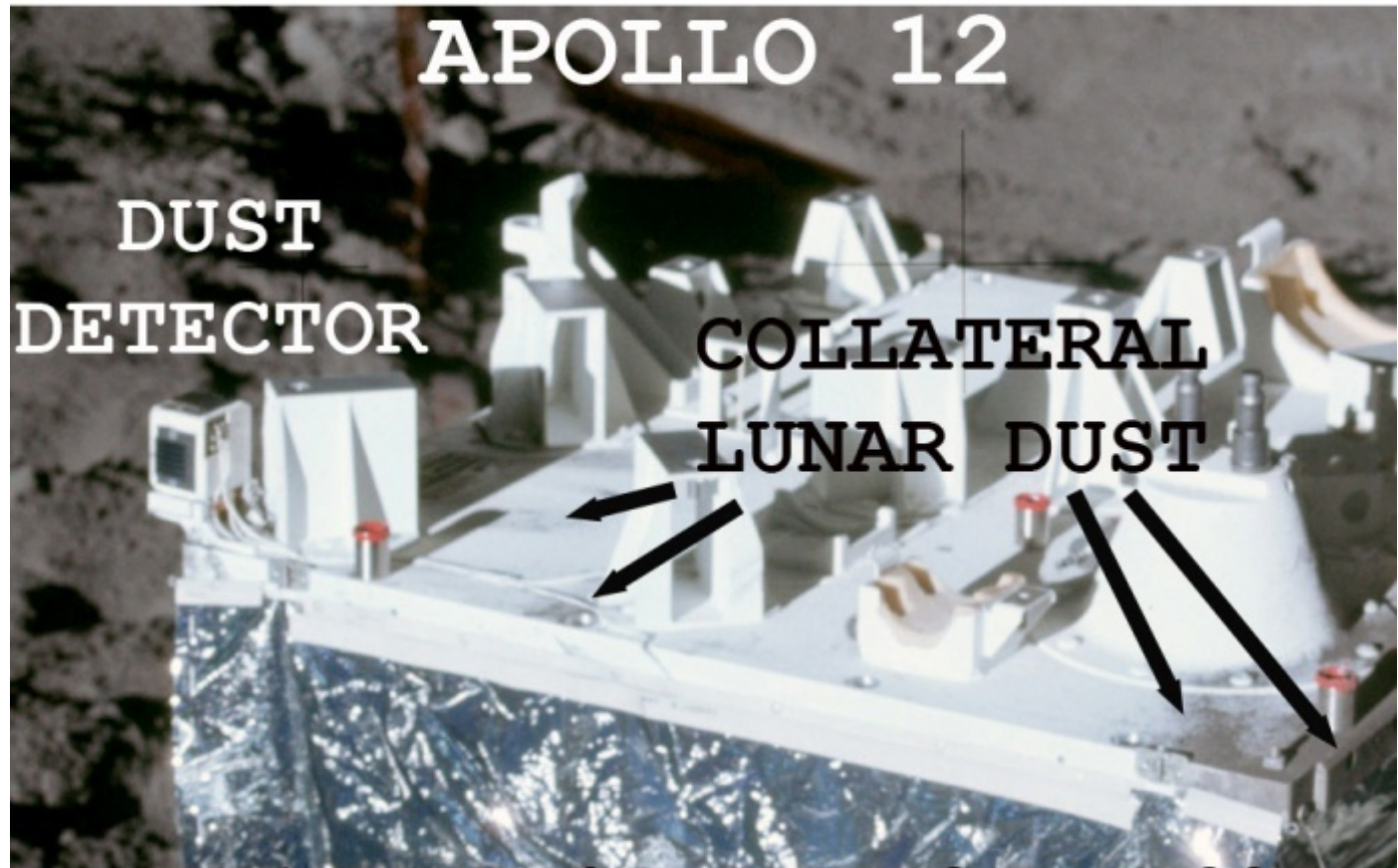


FIG.1: O'Brien GRL 6 May 09

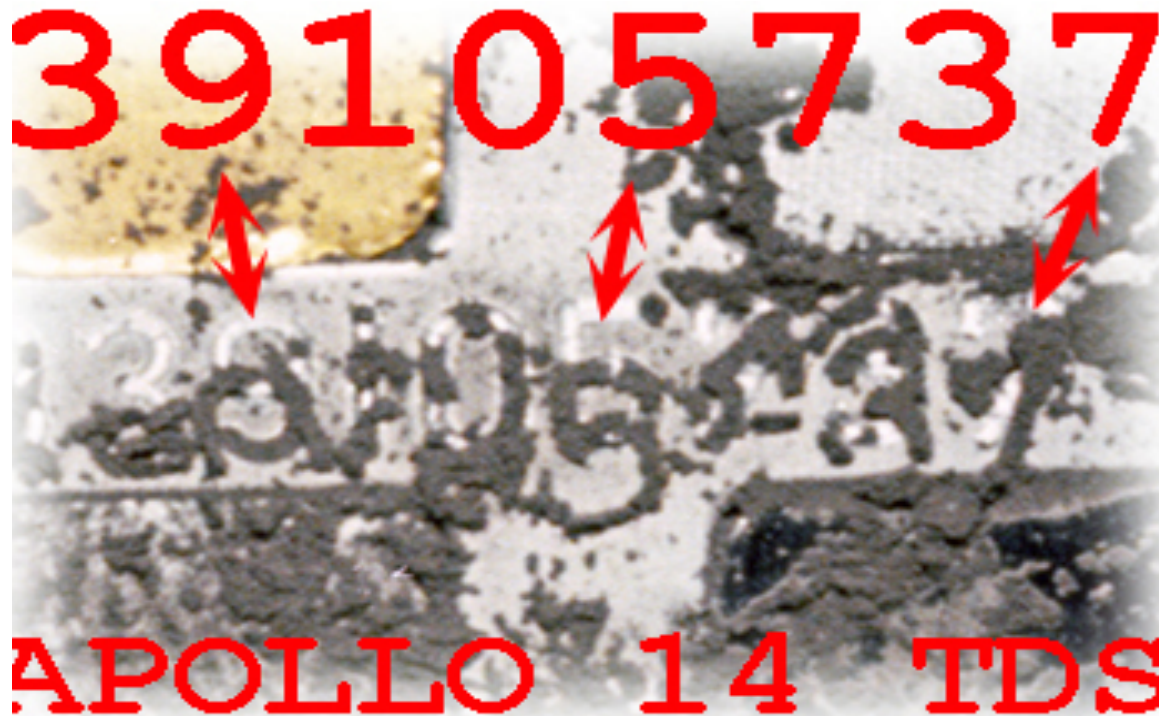


# DUST DETECTOR DDE

## DISCOVERIES

- O'BRIEN ET AL. *J. APPL. PHYS.* OCT., 1970
- O'BRIEN, doi:10.1029/2008GL037116, 2009
- O'BRIEN, doi:10.1016/pss.2011.04.016, 2011
- 7 DISCOVERIES OF "BASICS" TO DATE:
- 3 TYPES OF EFFECTS OF HUMAN ACTIVITIES;
- NATURAL EFFECTS ON STICKYNESS;
- SUNRISE ?HORIZON GLOW? (in preparation);
- ECLIPSES & LONG-TERM (7 YEAR) EFFECTS;
- ANALYSES CONTINUE, SELF-FUNDED

# THERMAL DEGRADATION SAMPLES (TDS)

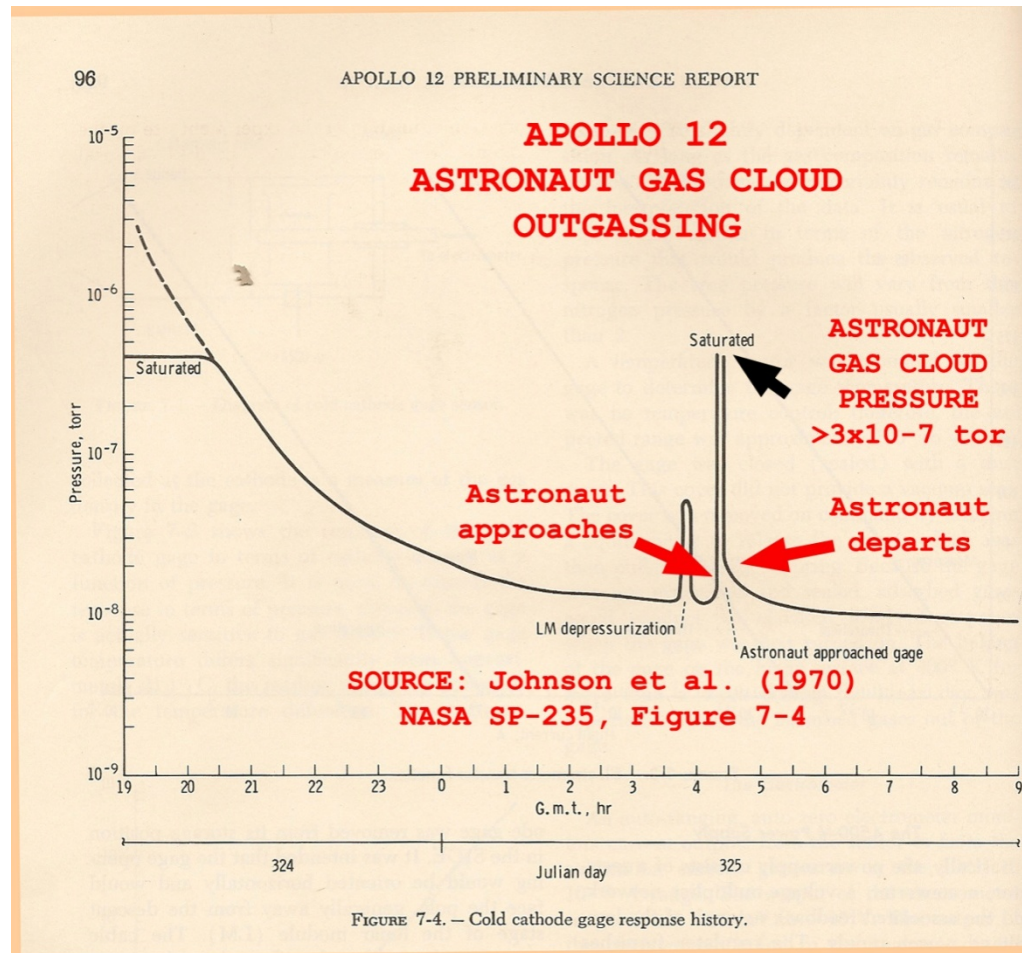


TDS LOST ON RETURN TO QUARANTINE

GOLD SP-272 (1971) FORGOTTEN, UNIQUE

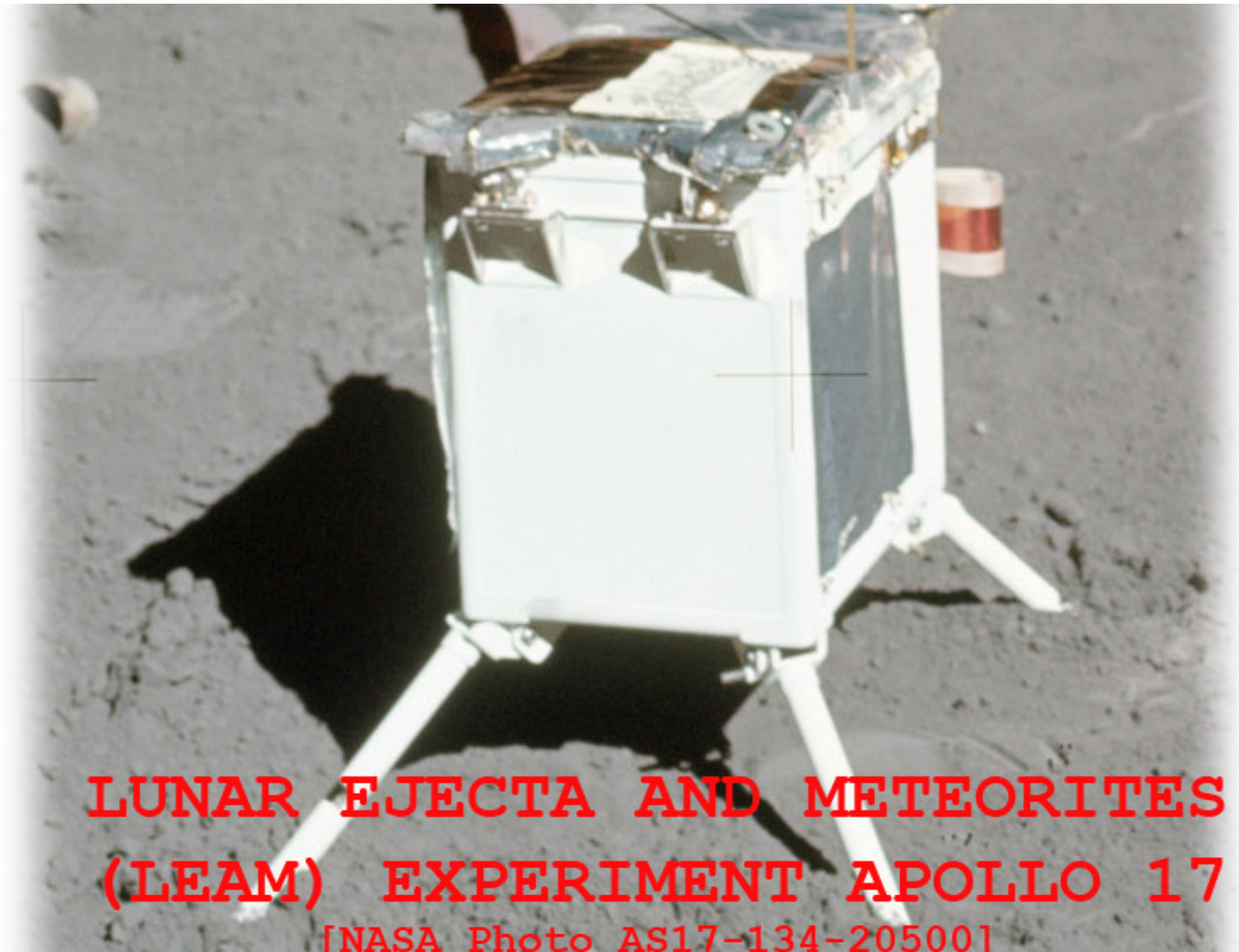
7 PHOTOS : **COHESIVE FORCE MEASURED**  
**INSIDE ASTRONAUT AURA** (O'BRIEN 2011)

# TDS INSIDE OUTGASSING AURA OF ASTRONAUT: CONTAMINATED



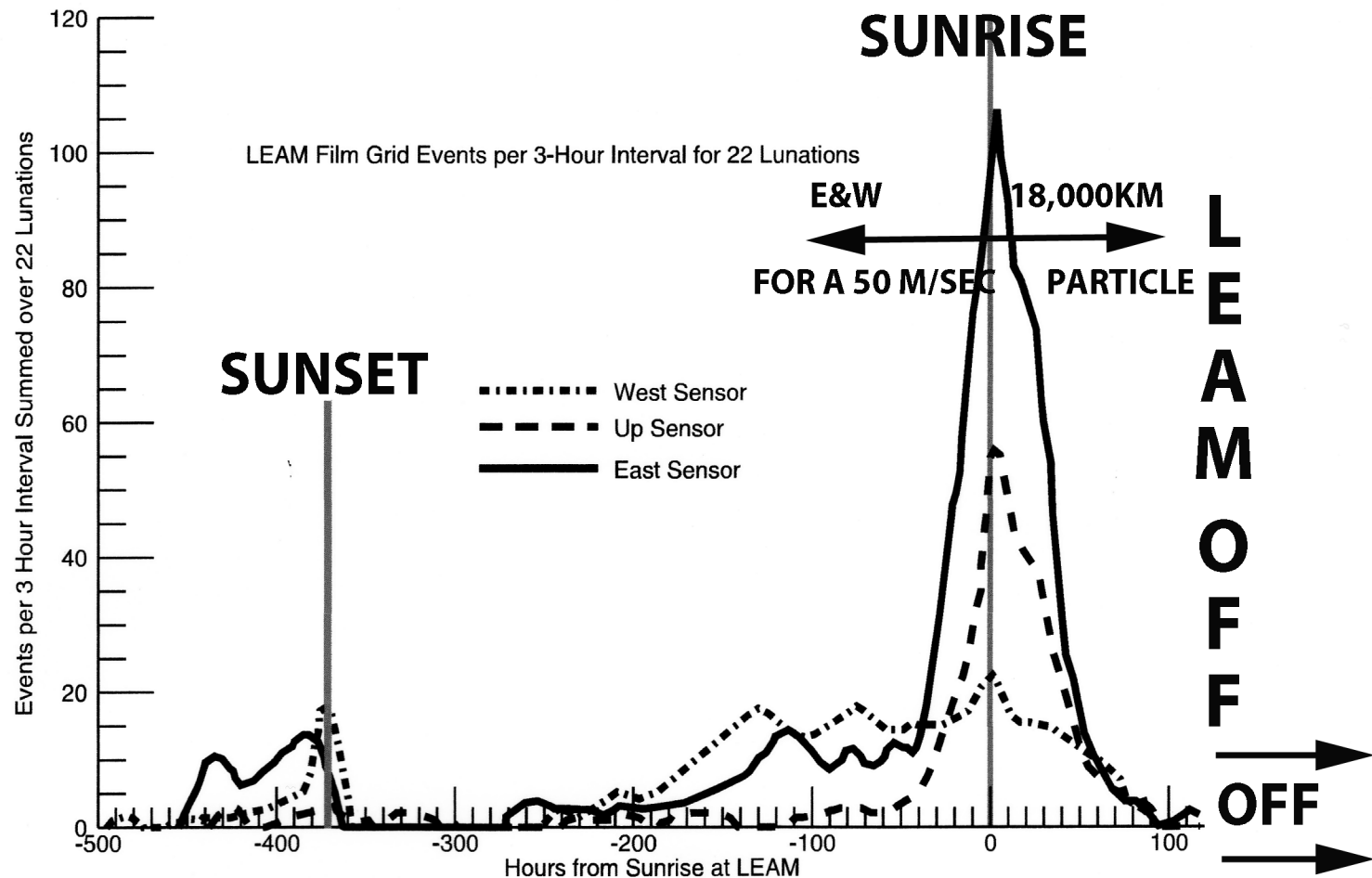


# LUNAR EJECTA & METEOROIDS (LEAM)





# LEAM DATA OVER 22 LUNATIONS





**LEAM HAD MANY PROBLEMS**

**ALSEP TERMINATION REPORT**

**“LEAM WAS CHECKED DURING  
EACH SUPPORT PERIOD;**

**LEAM SCIENCE DATA ALWAYS  
DEFECTIVE.” (BATES ET AL. 1979,  
PAGE 5-16).**

# 8 UNEXPECTED EFFECTS IN LEAM

1. DESIGNED TO MEASURE COSMIC DUST, DID NOT ?;
2. FALSE CLAIM “*VIRTUALLY IDENTICAL TO ..PIONEER 8*”: O’BRIEN (S.6.6) LISTS 14 MAJOR DIFFERENCES;
3. “EVENTS” FROM SINGLE FILMS NOT TELESCOPES;
4. COUNTS HUNDREDS OF TIMES EXPECTED;
5. PULSE HEIGHTS MAXIMUM, “*OPPOSITE EXPECTED*”;
6. EVENT COUNTER MULTIPLE ADVANCES PER EVENT;
7. OVERHEATING FORCED TURNOFF 200/700 HOURS;
8. COVERS ASSUMED OFF 9 DAYS AFTER COMMAND.

# CAUSE OF LEAM “EVENTS”: BELIEF SINCE 1977

- LEAM EVENTS “ASSUMED CONSISTENT WITH SUNRISE/SUNSET TRIGGERED LEVITATION & TRANSPORT OF SLOW MOVING HIGHLY-CHARGED LUNAR DUST PARTICLES” (COLWELL ET AL., Para 63);
- “**ARGUABLY, THE MOST COMPELLING EVIDENCE** FOR THE PRESENCE OF OTHER DUST POPULATIONS CAME FROM ...LEAM”.... SUCH AS A LEVITATED DUST EXOSPHERE (STUBBS ET AL., 2010, page 831)
- BUT **4 SUITES OF PARTICLES SUGGESTED BY BAILEY & FRANTSVOG (1977) SEEM NOT INVESTIGATED?;**
- AND **ARE LEAM PARTICLES +VE OR –VE OR BOTH??**



## **2 FOUNDATIONS OF 1977 HYPOTHESIS**

**1 PERKINS THEORETICAL CIRCUIT ANALYSIS**

**2 BAILEY LIMITED EXPERIMENTAL TESTS**

**PREDICT & FIND “MULTIPLE” EVENTS**

**COULD BE NEGATIVE OR POSITIVE**

**PARTICLES**

**REMAINING UNCERTAINTIES INCLUDE:**

- 4 SUITES OF OTHER PARTICLES (B&F 1977);**
- RANGE OF SPEEDS  $< 30\text{m/sec}$  AND  $100\text{m/sec}$  TO  $300\text{m/sec}$  UNEXPLORED;**
- MANY UNEXPLAINED FEATURES OF DATA**

# **“DETECTIVE O’BRIEN” CLUE BY CLUE**

- RAW DATA IN “BURSTS” MULTIPLE EVENTS
- CONCLUDE THAT DURATION OF A BURST  
<0.6 SECS OUT OF 3 HRS 18,000 FRAMES
- BENDIX TEST PRE-FLIGHT “NOISE BURSTS”
- ASK POSSIBLE LUNAR CAUSES OF BURSTS?
- IDENTIFY SUNRISE & SUNSET SWITCHING  
OF HEAVY CURRENTS IN DOZEN HEATERS
- BUT NO CORRELATION HAS YET BEEN  
MADE OF A SWITCH WITH A LEAM COUNT

# SUPPLEMENTARY CLUES

- ECLIPSES SURROGATE SUNRISE & SUNSET:  
NO INCREASED EVENTS – FAVOURS NOISE
- 5 TIMES MORE FREQUENT AT SUNRISE:  
INTERRUPT CURRENTS NOT START THEM
- NIGHT EVENTS: ALSEP SYSTEM SWITCHES
- ABSOLUTE # OF EVENTS (SCORES/DAY):  
ROUGHLY EQUAL # OF SWITCHES
- SO NEED TO RE-EXAMINE FOUNDATIONS  
OF 1977 LUNAR DUST HYPOTHESIS



# TWO PLAUSIBLE CAUSES OF LEAM COUNTS

## CAVEAT: LEAM HAD MANY OPERATIONAL PROBLEMS

### “LUNAR DUST” IS CONSISTENT ON 3 POINTS:

1. DOUBLE OR MULTIPLE COUNTING OF SLOW PULSES
2. INCOMPLETE LAB TESTS WITH IRON BALLS NOT DUST
3. THEORIES RE SUNRISE (& SUNSET?) HIGHER COUNTS

### “NOISE DUST” CONSISTENT ON 7 POINTS:

1. “BURSTS” IN TIME BUBBLES <0.6 SECONDS FROM NOISE
2. PRE-FLIGHT 3 TESTS CAUSED “NOISE BITS” ONLY IN LEAM
3. SUNRISE & SUNSET HIGHER COUNTS: PEAK # SWITCHES
4. 5 TIMES MORE SUNRISE COUNTS THAN # AT SUNSET \*
5. NO INCREASED COUNTS AT LUNAR ECLIPSES: *NO HEATERS\**
6. COUNTS DURING DEEP NIGHT: *FROM ALSEP SYSTEM\**
7. ABSOLUTE NUMBER OF EVENTS: *12 HEATERS + SYSTEM\**

**TO BE ADDED AFTER  
NLSI DISCUSSIONS 19-21 JULY**