



1  
00:00:02,610 --> 00:00:03,850  
>>> GOOD AFTERNOON.

2  
00:00:03,850 --> 00:00:05,480  
WELCOME TO NASA HEADQUARTERS IN  
WASHINGTON.

3  
00:00:05,480 --> 00:00:08,500  
I'M WADE BROWN WITH THE OFFICE  
OF COMMUNICATIONS.

4  
00:00:08,500 --> 00:00:13,549  
NASA'S NEW HORIZONS RESEARCH  
TEAM IS BACK TO REVEAL EVEN MORE

5  
00:00:13,549 --> 00:00:17,830  
UNPRECEDENTED IMAGES AND SCIENCE  
THAT CONTINUE TO BE RETURNED

6  
00:00:17,830 --> 00:00:21,750  
FROM THE NEW HORIZONS SPACECRAFT  
FOLLOWING ITS HISTORIC JULY 14th

7  
00:00:21,750 --> 00:00:24,180  
FLY BY PLUTO.

8  
00:00:24,180 --> 00:00:27,380  
LET'S SET THE STAGE FOR TODAY'S  
BRIEFING.

9  
00:00:27,380 --> 00:00:31,830  
PLEASE WELCOME TO THE PODIUM  
ASTRONAUT AND HEAD OF THE NASA

10  
00:00:31,830 --> 00:00:36,090  
DIRECTORATE WHERE NEW HORIZONS  
IS ONE OF ALMOST 100 SCIENCE

11  
00:00:36,090 --> 00:00:45,960

MISSIONS IN THE PORTFOLIO,  
LADIES AND GENTLEMEN, DR.

12

00:00:45,960 --> 00:00:49,489

JOHN  
GRUNGEFELD.

13

00:00:49,489 --> 00:00:50,600

>> THANK YOU VERY MUCH, DUANE.

14

00:00:50,600 --> 00:00:53,890

AND, YOU KNOW, THIS WEEK HAS  
BEEN JUST A PHENOMENAL WEEK.

15

00:00:53,890 --> 00:00:58,890

ON MONDAY WE LEASED THE FIRST  
IMAGE FROM THE EPIC EARTH

16

00:00:58,890 --> 00:01:03,969

POLYCHROMATIC IMAGING PROGRAM ON  
THE DISCOVER MISSION, THE BLUE

17

00:01:03,969 --> 00:01:04,969

MARVEL.

18

00:01:04,969 --> 00:01:08,400

THIS IS OUR FIRST, YOU KNOW,  
TRUE BLUE MARVEL OF THE EARTH

19

00:01:08,400 --> 00:01:13,890

SINCE 1972 WHEN THE APOLLO 17  
ASTRONAUTS TOOK THE FAMOUS BLUE

20

00:01:13,890 --> 00:01:15,310

MARVEL IMAGE OF THE EARTH.

21

00:01:15,310 --> 00:01:19,380

IT REALLY PAINTS I THINK AN  
INCREDIBLE PICTURE OF OUR HOME

22  
00:01:19,380 --> 00:01:24,810  
PLANET AND HOW, YOU KNOW, LUCKY  
AND PRECIOUS PLANET EARTH IS.

23  
00:01:24,810 --> 00:01:28,560  
ESPECIALLY WHEN YOU COMPARE IT  
TO THE AMAZING VIEWS WE'VE

24  
00:01:28,560 --> 00:01:32,170  
RECENTLY GOTTEN FROM THE DAWN  
SPACECRAFT, YOU KNOW, WHICH IS A

25  
00:01:32,170 --> 00:01:39,310  
SOMEWHAT SERIOUS, HOSTILE WORLD  
TO EARTH PLANET SERIES.

26  
00:01:39,310 --> 00:01:43,740  
WE'VE JUST ANNOUNCED YESTERDAY A  
KEPLER DISCOVERY OF SORT OF A

27  
00:01:43,740 --> 00:01:47,200  
PARALLEL, A COUSIN OF SOLAR  
SYSTEM TO THAT OF OUR OWN SOLAR

28  
00:01:47,200 --> 00:01:51,229  
SYSTEM WITH A G-TYPE STAR MUCH  
LIKE OUR SUN, A LITTLE BIT

29  
00:01:51,229 --> 00:01:57,740  
OLDER, AND AN EXOPLANET THAT'S  
ABOUT 60% BIGGER DIAMETER THAN

30  
00:01:57,740 --> 00:02:02,380  
THE EARTH RIGHT IN THE MIDDLE OF  
A HABITABLE ZONE.

31  
00:02:02,380 --> 00:02:04,400  
IT'S TRULY AMAZING THE THINGS  
THAT WE'RE DOING.

32

00:02:04,400 --> 00:02:09,850

BUT THE IMAGES THAT WE'VE BEEN  
GETTING AND THE SCIENCE WE'VE

33

00:02:09,850 --> 00:02:14,790

BEEN GETTING FROM PLUTO HAS  
REALLY JUST BEEN BEEN, YOU KNOW,

34

00:02:14,790 --> 00:02:20,730

MORE THAN AMAZING AND PROVES  
DEFINITELY A SCIENTIFIC THEORY

35

00:02:20,730 --> 00:02:24,880

THAT SCIENCE NEVER SLEEPS.

36

00:02:24,880 --> 00:02:27,590

AND IF YOU LOOK AT OUR PANEL  
HERE, THEY ACTUALLY LOOK PRETTY

37

00:02:27,590 --> 00:02:33,100

CHEERY FOR A GROUP OF SCIENTISTS  
THAT HAVE NOT BEEN SLEEPING FOR

38

00:02:33,100 --> 00:02:34,300

THE LAST FEW WEEKS.

39

00:02:34,300 --> 00:02:37,860

BUT THEY ARE HERE TO TELL US  
ABOUT THE MOST RECENT AMAZING

40

00:02:37,860 --> 00:02:41,360

RESULTS FROM THE PLUTO NEW  
HORIZONS MISSION.

41

00:02:41,360 --> 00:02:48,310

AND I'M JUST THRILLED TO BE HERE  
TO HEAR THOSE RESULTS.

42

00:02:48,310 --> 00:02:59,030

[ APPLAUSE ]

>> SO, WE HAVE -- BEFORE I

43

00:02:59,030 --> 00:03:04,480

INTRODUCE OUR PANELISTS FOR THIS  
AFTERNOON, OBVIOUSLY THE NASA

44

00:03:04,480 --> 00:03:09,569

COUNT SOCIAL MEDIA BUZZ WITH  
THIS MISSION AND THE RESULTS AND

45

00:03:09,569 --> 00:03:13,150

THE IMAGES FOLLOW THE NASA  
ACCOUNTS ON TWITTER.

46

00:03:13,150 --> 00:03:16,970

YOUTUBE, FACEBOOK, AND OTHER  
NASA COUNTS.

47

00:03:16,970 --> 00:03:21,990

SEND IN YOUR QUESTIONS  
AT #ASKNASA.

48

00:03:21,990 --> 00:03:23,090

A LOT OF QUESTIONS ARE COMING  
IN.

49

00:03:23,090 --> 00:03:26,430

WE'LL TRY TO ANSWER THOSE AS  
QUICKLY AS POSSIBLE.

50

00:03:26,430 --> 00:03:27,720

KEEP THEM COMING IN.

51

00:03:27,720 --> 00:03:30,519

YOU CAN FOLLOW THE CONVERSATION  
AND THERE'S STILL A LOT OF

52

00:03:30,519 --> 00:03:34,550

CONVERSATION ALL OVER THE WORLD

ON THIS HISTORIC MISSION AT

53

00:03:34,550 --> 00:03:36,830

A #PLUTOFLYBY.

54

00:03:36,830 --> 00:03:42,010

AGAIN, ONLINE, ALL OF THE  
INFORMATION TODAY AND IN THE

55

00:03:42,010 --> 00:03:51,300

FUTURE CAN BE OBTAINED BY GOING  
TO [WWW.NASA.GOV/NEWHORIZONS](http://WWW.NASA.GOV/NEWHORIZONS).

56

00:03:51,300 --> 00:03:56,400

FIRST UP YOU WILL HEAR FROM JIM  
GREEN, DIRECTOR OF PLANETARY

57

00:03:56,400 --> 00:04:02,909

SCIENCE AT NASA HEADQUARTERS.

58

00:04:02,909 --> 00:04:07,349

ALAN STERN, NEW HORIZONS  
PRINCIPAL INVESTOR AT SOUTHWEST

59

00:04:07,349 --> 00:04:14,950

RESEARCH INSTITUTE IN BOULDER,  
COLORADO.

60

00:04:14,950 --> 00:04:18,950

MICHAEL SOMERS, NEW HORIZONS  
CO-INVESTOR AT GEORGE MASON

61

00:04:18,950 --> 00:04:24,719

UNIVERSITY, FAIRFAX, VIRGINIA.

62

00:04:24,719 --> 00:04:29,300

KATHY OLKIN, NEW HORIZONS DEPUTY  
PROJECT SCIENTIST, ALSO AT THE

63

00:04:29,300 --> 00:04:33,930  
SOUTHWEST RESEARCH INSTITUTE.

64  
00:04:33,930 --> 00:04:37,229  
AND ROYAL McKINNON, NEW HORIZONS  
CO-INVESTIGATOR AT WASHINGTON

65  
00:04:37,229 --> 00:04:39,089  
UNIVERSITY IN ST.

66  
00:04:39,089 --> 00:04:40,089  
LOUIS.

67  
00:04:40,089 --> 00:04:42,989  
WITH THAT, I'LL TURN IT OVER TO  
JIM.

68  
00:04:42,989 --> 00:04:43,989  
>> THANK YOU VERY MUCH, DUANE.

69  
00:04:43,989 --> 00:04:49,039  
YOU KNOW, JULY 14th WAS VERY  
HISTORIC FOR NASA WITH OUR VERY

70  
00:04:49,039 --> 00:04:51,779  
SUCCESSFUL FLYBY OF THE NEW  
HORIZONS SPACECRAFT NEAR THE

71  
00:04:51,779 --> 00:04:53,300  
PLUTO SYSTEM.

72  
00:04:53,300 --> 00:04:56,770  
AND WE'RE JUST TEN DAYS FROM  
THAT, AND YET WE'VE ONLY HAD

73  
00:04:56,770 --> 00:05:00,479  
ABOUT AN OPPORTUNITY TO SEE  
ABOUT 5% OF THE DATA.

74

00:05:00,479 --> 00:05:04,629  
AS MANY KNOW, WE STORED THAT  
DATA ON BOARD AS WE FLEW THROUGH

75  
00:05:04,629 --> 00:05:07,879  
THE SYSTEM AND IT'S JUST NOW  
STARTING TO COME BACK.

76  
00:05:07,879 --> 00:05:12,309  
EACH AND EVERY DAY THE SCIENCE  
TEAM HAS BEEN HUDDLED LOOKING AT

77  
00:05:12,309 --> 00:05:16,529  
THE DATA AS IT COMES BACK AND  
IT'S ALWAYS SURPRISED AND JUST

78  
00:05:16,529 --> 00:05:19,919  
QUITE A PLEASURE TO BE PART OF  
THAT TEAM, TO LOOK AT THE DATA

79  
00:05:19,919 --> 00:05:23,259  
WHEN IT COMES IN, AND SEE THE  
NEW DISCOVERIES THAT ARE COMING

80  
00:05:23,259 --> 00:05:24,259  
OUT.

81  
00:05:24,259 --> 00:05:26,960  
NOW, TODAY WE'RE GOING TO TALK  
ABOUT SOME OF THE LATEST DATA

82  
00:05:26,960 --> 00:05:29,860  
THAT CAME IN WITHIN THE LAST FEW  
DAYS.

83  
00:05:29,860 --> 00:05:33,289  
THIS IS A SPECTACULAR SET OF  
DATA, BUT IT'S ALSO DATA THAT

84  
00:05:33,289 --> 00:05:38,300

HAPPENED AND WAS TAKEN ON BOARD,  
STORED PRIOR TO THE ENCOUNTER

85  
00:05:38,300 --> 00:05:42,469  
AND ITS POSTENCOUNTER, AFTER THE  
SPACECRAFT HAD AN OPPORTUNITY TO

86  
00:05:42,469 --> 00:05:47,870  
FLY THROUGH THE PLUTO SYSTEM AND  
LOOK BACK TO PLUTO AS IT'S

87  
00:05:47,870 --> 00:05:51,749  
HURLING AWAY AT MORE THAN 16  
KILOMETERS PER SECOND.

88  
00:05:51,749 --> 00:05:54,839  
THESE ARE JUST AMAZING  
DISCOVERIES.

89  
00:05:54,839 --> 00:05:57,490  
SO WITHOUT FURTHER ADO, ALLOW ME  
TO TURN IT OVER TO THE PRINCIPAL

90  
00:05:57,490 --> 00:06:00,539  
VOR, ALAN STERN, TO START IT  
OFF.

91  
00:06:00,539 --> 00:06:01,539  
ALAN?

92  
00:06:01,539 --> 00:06:02,539  
>> THANK YOU, JIM.

93  
00:06:02,539 --> 00:06:06,819  
AS JIM SAID, LAST WEEK THE  
UNITED STATES, THROUGH OUR

94  
00:06:06,819 --> 00:06:11,550  
PROJECT AND NASA, EXPLORED THE  
FARTHEST FRONTIER EVER EXPLORED

95

00:06:11,550 --> 00:06:14,050

BY HUMANKIND, THE PLUTO SYSTEM.

96

00:06:14,050 --> 00:06:17,080

WE CAN'T TELL YOU HOW HAPPY WE  
ARE TO BE BACK AS A TEAM AND

97

00:06:17,080 --> 00:06:19,259

TELL YOU WHAT WE'VE BEEN  
DISCOVERING.

98

00:06:19,259 --> 00:06:25,360

WE CAME BACK LAST FRIDAY TO GIVE  
A FIRST REPORT ABOUT FIRST

99

00:06:25,360 --> 00:06:27,490

REACTIONS TO DATA DOWNLOAD.

100

00:06:27,490 --> 00:06:31,580

TEN DAYS OUT, 7.5 MILLION MILES  
FROM PLUTO, WE'VE HAD MORE TIME

101

00:06:31,580 --> 00:06:36,210

TO THINK ABOUT THE DATA SETS  
THAT ARE ON THE GROUND AND

102

00:06:36,210 --> 00:06:38,800

EQUALLY IMPORTANTLY, WE HAVE  
ABOUT THREE TIMES AS MUCH DATA

103

00:06:38,800 --> 00:06:40,729

ON THE GROUND.

104

00:06:40,729 --> 00:06:44,779

NOW, IT'S NOT VERY MUCH OF THE  
TOTAL DATA LOAD.

105

00:06:44,779 --> 00:06:47,389

WE HAVE ABOUT 4% TO 5% OF THE  
DATA BACK.

106

00:06:47,389 --> 00:06:51,449

95% OR 96% OF IT IS STILL ON THE  
SPACECRAFT SO WE'RE ONLY

107

00:06:51,449 --> 00:06:54,449

SCRATCHING THE SURFACE AND WE  
HAVE SOME GREAT DISCOVERIES TO

108

00:06:54,449 --> 00:06:55,830

TELL YOU ABOUT.

109

00:06:55,830 --> 00:06:59,550

ALSO, THE SIZE OF THE DATA SETS,  
THERE'S ONE OTHER WAY ON THIS

110

00:06:59,550 --> 00:07:03,499

PROJECT TO KNOW THAT WE'VE DONE  
THE EXPLORATION ON THE OTHER

111

00:07:03,499 --> 00:07:07,099

SIDE OF PLUTO, AND THAT'S THIS  
BUMPER STICKER THAT'S INSPIRED

112

00:07:07,099 --> 00:07:10,369

BY VAL MALDER, OUR DEPUTY  
ASSISTANTS ENGINEER.

113

00:07:10,369 --> 00:07:13,370

IT SAYS, "MY OTHER VEHICLE  
EXPLORED PLUTO."

114

00:07:13,370 --> 00:07:17,169

A NICE PICTURE OF PLUTO MADE BY  
NEW HORIZONS IN THE REAR-VIEW

115

00:07:17,169 --> 00:07:18,169

MIRROR.

116

00:07:18,169 --> 00:07:20,550

THAT'S HOW YOU KNOW.

117

00:07:20,550 --> 00:07:22,759

I WANT TO SAY A FEW THINGS AND  
I'D LIKE TO CALL UP MY FIRST

118

00:07:22,759 --> 00:07:26,899

GRAPHIC, WHICH IS A HAUNTINGLY  
IMAGE OF THE DOUBLE PLANET

119

00:07:26,899 --> 00:07:30,310

SYSTEM PLUTO SHARING WITH PLUTO  
ON THE LEFT AND SHARON ON THE

120

00:07:30,310 --> 00:07:31,310

RIGHT.

121

00:07:31,310 --> 00:07:34,809

THIS IS MADE A FEW DAYS OUT ON  
APPROACH WITH TRUE COLOR ADDED

122

00:07:34,809 --> 00:07:38,240

FROM OUR RALPH INSTRUMENT ON TOP  
OF THE LURIE IMAGE.

123

00:07:38,240 --> 00:07:42,150

AS I TELL YOU ABOUT WHERE WE ARE  
IN THE MISSION, JUST FEAST YOUR

124

00:07:42,150 --> 00:07:43,369

EYES ON THIS.

125

00:07:43,369 --> 00:07:45,949

WE'VE NEVER BEEN TO A DOUBLE  
PLANET SYSTEM BEFORE, AND IT'S

126

00:07:45,949 --> 00:07:50,379

TURNING OUT TO BE A SCIENTIFIC  
WONDERLAND.

127

00:07:50,379 --> 00:07:53,839

WE'VE NOW FINISHED THE FIRST  
PHASE OF DOWNLINK.

128

00:07:53,839 --> 00:07:56,610

THAT WAS AN INTENSIVE TEN-DAY  
PERIOD IN WHICH WE SENT DOWN

129

00:07:56,610 --> 00:08:00,089

IMAGES AND SPECTRA AND OTHER  
DATA SETS JUST TO WHET OUR

130

00:08:00,089 --> 00:08:04,059

APPETITES AND TELL US THE BASICS  
ABOUT THE PLUTO SYSTEM AND THE

131

00:08:04,059 --> 00:08:07,979

DISCOVERIES YOU'LL BE HEARING  
ABOUT BY MYSELF AND MIKE, KATHY,

132

00:08:07,979 --> 00:08:12,339

AND BILL REPORT ON SOME OF THE  
MOST IMPORTANT FINDINGS THAT

133

00:08:12,339 --> 00:08:15,430

WE'VE ALREADY MADE IN THESE FEW  
DAYS.

134

00:08:15,430 --> 00:08:17,580

WE'RE NOW MOVING INTO A SECOND  
PHASE OF DOWNLINK.

135

00:08:17,580 --> 00:08:19,810

IT'S A LITTLE BIT DIFFERENT, AND  
I THINK IT'S IMPORTANT THAT

136

00:08:19,810 --> 00:08:22,659

EVERYONE UNDERSTAND THAT  
DIFFERENCE.

137

00:08:22,659 --> 00:08:25,969

WE'LL BE TRANSMITTING HOME NOW A  
LOT OF ENGINEERING DATA FROM THE

138

00:08:25,969 --> 00:08:31,919

FLYBY AS WELL AS DAY DATA FROM  
OUR PLASMA, OUR STUDENT COUNTER

139

00:08:31,919 --> 00:08:36,180

AND HEADER DATA TO GO WITH THE  
IMAGES AND SPECTER WE'VE ALREADY

140

00:08:36,180 --> 00:08:37,180

GOT.

141

00:08:37,180 --> 00:08:39,210

SO FOR THE NEXT COUPLE OF  
MONTHS, UNTIL WE REACH

142

00:08:39,210 --> 00:08:43,250

MID-SEPTEMBER, IT WILL ONLY BE  
OCCASIONALLY THAT WE'LL HAVE NEW

143

00:08:43,250 --> 00:08:47,279

IMAGES ON THE GROUND AND  
AVAILABLE TO RELEASE.

144

00:08:47,279 --> 00:08:51,550

BUT STARTING IN SEPTEMBER, THE  
SPIGOT OPENS AGAIN, AND THEN FOR

145

00:08:51,550 --> 00:08:55,420

ABOUT A YEAR, MAYBE A LITTLE BIT  
MORE, THE SKY WILL BE RAINING

146

00:08:55,420 --> 00:08:59,180

PRESENTS WITH DATA FROM THE

PLUTO SYSTEM.

147

00:08:59,180 --> 00:09:00,920

IT'S GOING TO BE QUITE A RIDE.

148

00:09:00,920 --> 00:09:02,649

WE'RE REALLY HAPPY ABOUT THE  
AMOUNT OF INTEREST IN THIS

149

00:09:02,649 --> 00:09:04,329

MISSION AS A MISSION TEAM.

150

00:09:04,329 --> 00:09:06,480

WE'RE EXCITED TO SHARE IT WITH  
ALL OF YOU.

151

00:09:06,480 --> 00:09:08,060

AND WE'RE GOING TO DO SOME OF  
THAT RIGHT NOW.

152

00:09:08,060 --> 00:09:11,240

WE'RE GOING GET RIGHT INTO THE  
SCIENCE.

153

00:09:11,240 --> 00:09:13,801

FOR SOME OF YOU, IF YOU'RE  
SEEING A CARDIOLOGIST YOU MAY

154

00:09:13,801 --> 00:09:16,209

WANT TO LEAVE THE ROOM.

155

00:09:16,209 --> 00:09:17,209

THERE ARE SOME PRETTY MIND  
PLEAU

156

00:09:17,209 --> 00:09:19,550

-BLOWING DISCOVERIES I'M GOING  
TO TALK ABOUT.

157

00:09:19,550 --> 00:09:24,029  
MY SECOND GRAPHIC, OUR 2 X 2  
MOSAIC OF THE PLUTO SYSTEM.

158  
00:09:24,029 --> 00:09:28,410  
THIS HAS TWICE THE RESOLUTION OF  
THE PREVIOUS BEST GLOBAL IMAGE

159  
00:09:28,410 --> 00:09:30,440  
OF THE APPROACH HEMISPHERE.

160  
00:09:30,440 --> 00:09:32,740  
AND REALLY IT'S JUST MOUTH  
WATERING.

161  
00:09:32,740 --> 00:09:36,370  
THE LEVEL OF DETAIL IS  
SPECTACULAR.

162  
00:09:36,370 --> 00:09:40,600  
THIS IMAGE HAS A RESOLUTION OF  
ABOUT 2.2 KILOMETERS PER PIXEL,

163  
00:09:40,600 --> 00:09:45,060  
AND I THINK JUST LOOKING AT IT,  
YOU CAN TELL AS OUR SCIENCE TEAM

164  
00:09:45,060 --> 00:09:49,029  
CAN, THAT PLUTO HAS A VERY  
COMPLICATED STORY TO TELL.

165  
00:09:49,029 --> 00:09:52,380  
PLUTO HAS A VERY INTERESTING  
HISTORY, AND THERE IS A LOT OF

166  
00:09:52,380 --> 00:09:55,529  
WORK THAT WE NEED TO DO TO  
UNDERSTAND THIS VERY COMPLICATED

167  
00:09:55,529 --> 00:09:56,560

PLACE.

168

00:09:56,560 --> 00:09:57,560

I WANT TO STRESS THAT.

169

00:09:57,560 --> 00:10:02,310

I WANT TO DRIVE IT HOME BY  
SHOWING YOU THIS IMAGE OF HIGHER

170

00:10:02,310 --> 00:10:03,310

MAGNIFICATION.

171

00:10:03,310 --> 00:10:05,470

IF I CAN GO TO THE NEXT TIME  
STEP, WE'RE GOING TO LOOK AT

172

00:10:05,470 --> 00:10:08,970

JUST THE NORTHERN HALF OF THAT  
IMAGE.

173

00:10:08,970 --> 00:10:12,220

WE COULD EASILY BLOW IT UP EVEN  
FURTHER.

174

00:10:12,220 --> 00:10:14,660

YOU CAN SEE ACROSS THE NORTHERN  
TERRAINS HERE WHICH INCLUDE THE

175

00:10:14,660 --> 00:10:18,879

NORTH POLE, BY THE WAY, THIS IS  
A TRUE COLOR IMAGE, ESSENTIALLY

176

00:10:18,879 --> 00:10:22,769

TRUE COLOR AS YOUR EYE MIGHT SEE  
IT, A WHOLE RANGE OF GEOLOGIC

177

00:10:22,769 --> 00:10:23,829

EXPRESSION.

178

00:10:23,829 --> 00:10:26,509  
KATHY AND BILL WILL BE TALKING  
ABOUT THIS QUITE A BIT MORE SO I

179  
00:10:26,509 --> 00:10:30,900  
WON'T STEAL THEIR THUNDER, BUT  
JUST LET YOUR EYES GAZE FROM THE

180  
00:10:30,900 --> 00:10:36,110  
LAST ON THE WESTERN LIMB ACROSS  
THE DISK OVER TO THE EAST AND

181  
00:10:36,110 --> 00:10:38,949  
YOU CAN SEE DIFFERENT GEOLOGICAL  
UNITS, DIFFERENT KIND OF

182  
00:10:38,949 --> 00:10:42,870  
FEATURES TELLING THAT  
COMPLICATED STORY AGAIN, WHICH

183  
00:10:42,870 --> 00:10:44,459  
IS THERE FOR US TO UNRAVEL.

184  
00:10:44,459 --> 00:10:47,440  
AND IF I CAN HAVE THE NEXT TIME  
STEP AND WE CAN GO TO THE SOUTH,

185  
00:10:47,440 --> 00:10:52,220  
YOU SEE A STILL MORE COMPLICATED  
STORY WITH A GREAT EQUATORIAL

186  
00:10:52,220 --> 00:10:57,100  
DARK REGIONS, WITH TAMBA REGGIO,  
AS WE INFORMALLY CALL IT, THE

187  
00:10:57,100 --> 00:11:03,069  
HEART ON PLUTO, AND WHAT LOOKS  
LIKE MASSIVE TECTONIC FEATURES,

188  
00:11:03,069 --> 00:11:06,779

BOTH RADIALLY EMANATING FROM  
TAMB ACTION REGGIO AND OTHERS

189

00:11:06,779 --> 00:11:10,519

THAT RUN MORE OR LESS  
NORTH/SOUTH.

190

00:11:10,519 --> 00:11:13,759

I DO WANT TO TELL YOU ABOUT ONE  
ASPECT OF THE INTERPRETATION

191

00:11:13,759 --> 00:11:16,529

THAT WE'VE BEEN MAKING OVER THE  
LAST WEEK IN LOOKING MORE

192

00:11:16,529 --> 00:11:22,029

CAREFULLY AT THE IMAGERY OF THE  
HEART, LIKE A REAL HEART, IT HAS

193

00:11:22,029 --> 00:11:25,759

TWO LOBES, ON THE LEFT AND ON  
THE RIGHT SIDE.

194

00:11:25,759 --> 00:11:27,829

THE LEFT IS THE WESTERN SIDE.

195

00:11:27,829 --> 00:11:30,029

I THINK EVE ON THE YOUR EYE YOU  
CAN DISTINGUISH A DIFFERENCE

196

00:11:30,029 --> 00:11:31,439

BETWEEN THE TWO.

197

00:11:31,439 --> 00:11:34,529

THE RIGHT LOBE LOOKS LIKE A MUCH  
THINNER DEPOSIT THAT'S BEEN

198

00:11:34,529 --> 00:11:36,970

PAINTED ON TOP OF TOPOGRAPHY.

199

00:11:36,970 --> 00:11:40,019

OUR INTERPRETATION OF THAT  
MATERIAL IN THE RIGHT LOBE AS

200

00:11:40,019 --> 00:11:43,970

WELL AS THE MATERIAL EMANATING  
TO THE SOUTH BELOW THE WESTERN

201

00:11:43,970 --> 00:11:48,730

LOBE IS THAT IN BOTH CASES WE  
BELIEVE THE SOURCE FOR THAT

202

00:11:48,730 --> 00:11:51,180

MATERIAL IS THE WESTERN LOBE.

203

00:11:51,180 --> 00:11:58,439

IT'S BEING TRANSPORTED OFF THE  
WESTERN REGION OF THE WESTERN

204

00:11:58,439 --> 00:12:04,970

LOBE, PERHAPS BY SUBLIMATION AND  
WINDS AND RECONDENSATION OR

205

00:12:04,970 --> 00:12:07,100

PERHAPS BY A PROCESS WE HAVEN'T  
THOUGHT ABOUT.

206

00:12:07,100 --> 00:12:11,160

IN ANY CASE WE THINK WE'RE  
COMING TO UNDERSTAND THIS

207

00:12:11,160 --> 00:12:12,370

FEATURE JUST A LITTLE BIT.

208

00:12:12,370 --> 00:12:14,279

THIS IS EARLY DAYS.

209

00:12:14,279 --> 00:12:17,689

MAY HAVE A LITTLE MORE TO SAY

ABOUT THAT.

210

00:12:17,689 --> 00:12:24,670  
OUR NEXT TIME STEP IS A FALSE  
COLOR IMAGE STRETCHED TO SHOW

211

00:12:24,670 --> 00:12:29,130  
THE DRAMATIC DIFFERENCES IN  
COLOR UNITS ON PLUTO AND HOW

212

00:12:29,130 --> 00:12:30,899  
THEY CORRELATE WITH THE GEOLOGY.

213

00:12:30,899 --> 00:12:32,009  
THIS IS PRETTY MIND-BLOWING.

214

00:12:32,009 --> 00:12:34,139  
KATHY WILL HAVE MORE TO SAY  
ABOUT IT AND WHAT IT MEANS IN

215

00:12:34,139 --> 00:12:37,250  
THE BIGGER PICTURE.

216

00:12:37,250 --> 00:12:45,839  
BUT THEY HAVE DIFFERENT COLORS.

217

00:12:45,839 --> 00:12:48,540  
SOON WE'LL HAVE COMPOSITION  
SPECK TROS COE PI TO SUPPORT

218

00:12:48,540 --> 00:12:50,990  
THAT AT VERY HIGH-RESOLUTION.

219

00:12:50,990 --> 00:12:55,079  
YOU CAN SEE THE POLAR REGIONS  
HAVE A DIFFERENT COLOR STILL AND

220

00:12:55,079 --> 00:12:58,180  
A WE GET INTO THE DARK

EQUATORIAL REGIONS THERE'S MORE

221

00:12:58,180 --> 00:12:59,180  
INFORMATION.

222

00:12:59,180 --> 00:13:02,449  
THE GEOLOGY AND THE COLOR,  
PROBABLY THE COMPOSITION SEEM TO

223

00:13:02,449 --> 00:13:04,450  
BE CORRELATED.

224

00:13:04,450 --> 00:13:07,879  
THIS TELLS US THE PAYLOAD WE  
BROUGHT TO BEAR ON THE

225

00:13:07,879 --> 00:13:11,249  
RECONNAISSANCE OF PLUTO SYSTEM  
IS REALLY THE RIGHT PAYLOAD

226

00:13:11,249 --> 00:13:14,180  
BECAUSE WE HAVE ON BOARD THE  
SPACECRAFT NOW TREMENDOUS DATA

227

00:13:14,180 --> 00:13:16,930  
SETS WITH HIGHER RESOLUTION  
COLORS THAN THIS, HIGHER

228

00:13:16,930 --> 00:13:20,819  
RESOLUTION AND CHROMATIC MAPPING  
FOR DOING THE GEOLOGY.

229

00:13:20,819 --> 00:13:24,579  
AND A SPECTACULAR DATA SET WITH  
COMPOSITIONAL INFORMATION WITH

230

00:13:24,579 --> 00:13:28,829  
MORE THAN 64,000 PIXELS WE'VE  
PUT ON THE SURFACE.

231

00:13:28,829 --> 00:13:33,579

WE'LL BE ABLE TO TELL THIS STORY  
WELL OVER THE NEXT YEAR.

232

00:13:33,579 --> 00:13:36,079

LOOKING FORWARD TO THAT.

233

00:13:36,079 --> 00:13:38,850

I'M GOING TO MOVE ON TO THE NEXT  
TIME STEP, TELL YOU A LITTLE

234

00:13:38,850 --> 00:13:43,170

ABOUT ATMOSPHERIC SCIENCE WHERE  
WE'VE ALSO MADE SOME ADVANCES.

235

00:13:43,170 --> 00:13:46,889

THIS PARTICULAR GRAPH IS TO  
ILLUSTRATE SOMETHING ABOUT OUR

236

00:13:46,889 --> 00:13:52,420

ULTRAVIOLET MUTATION.

237

00:13:52,420 --> 00:13:53,420

THIS IS AN EXPERIMENT THAT WE

238

00:13:53,420 --> 00:13:58,019

DESIGNED AN ATMOSPHERE AROUND  
PLUTO'S LARGEST MOON.

239

00:13:58,019 --> 00:14:01,959

THERE'S BEEN A PRETTY BIG BODY  
OF LITERATURE SPECULATING ABOUT

240

00:14:01,959 --> 00:14:04,900

HOW SHARON COULD HAVE AN  
ATMOSPHERE.

241

00:14:04,900 --> 00:14:07,649

WE GOT THE SUMMARY DATA DOWN IN

THE LAST FEW DAYS.

242

00:14:07,649 --> 00:14:11,930  
WE DON'T HAVE THE FULL SPECTRAL  
DATA SET AND WON'T UNTIL

243

00:14:11,930 --> 00:14:12,930  
SEPTEMBER.

244

00:14:12,930 --> 00:14:18,459  
BUT IF YOU LOOK AT THAT STEP,  
YOU'LL BE ABLE TO SEE THE YELLOW

245

00:14:18,459 --> 00:14:23,459  
LINE REPRESENTS THE PATH OF THE  
SUN AS SEEN BY THE -- FROM THE

246

00:14:23,459 --> 00:14:27,000  
SPACECRAFT MOVING BEHIND SHARON.

247

00:14:27,000 --> 00:14:30,820  
IT CLIPS THE NORTHERN REGION OF  
THE MOON.CHARON.

248

00:14:30,820 --> 00:14:36,000  
IT CLIPS THE NORTHERN REGION OF  
THE MOON.

249

00:14:36,000 --> 00:14:40,610  
JUST AS YOU CLICK ON EITHER SIDE  
OF THE BODY, YOU CAN SEE IN THAT

250

00:14:40,610 --> 00:14:44,149  
RED AND WHITE GRAPH THAT THE  
LIGHT-FOOT LEVEL THE SUN

251

00:14:44,149 --> 00:14:45,709  
PLUMMETS STRAIGHT TO ZERO.

252

00:14:45,709 --> 00:14:49,750  
DOESN'T LOOK ANYTHING LIKE THE  
SOLAR DATA WE SHOWED YOU LAST

253  
00:14:49,750 --> 00:14:52,990  
WEEK FOR PLUTO, WHERE WE COULD  
CLEARLY SEE A REFRACTIVE

254  
00:14:52,990 --> 00:14:56,639  
SIGNATURE, A SLOW DECLINE IN THE  
LIGHT LEVELS.

255  
00:14:56,639 --> 00:14:59,079  
HERE IT'S JUST BASICALLY A  
SQUARE WAY, TELLING US THAT

256  
00:14:59,079 --> 00:15:03,009  
CHARON HAS MUCH LESS ATMOSPHERE  
THAN PLUTO IF ANY.

257  
00:15:03,009 --> 00:15:06,019  
WE CAN'T PUT STRICT BOUNDS ON IT  
BECAUSE WE DON'T HAVE THE

258  
00:15:06,019 --> 00:15:11,269  
SPECTRA BUT WE'LL BE ABLE TO IN  
SEPTEMBER BECAUSE THOSE WILL BE

259  
00:15:11,269 --> 00:15:12,269  
DOWNLINKED.

260  
00:15:12,269 --> 00:15:16,220  
FOR NOW WE CAN ASSAY IT'S A MUCH  
MORE RAREFIED ATMOSPHERE AND

261  
00:15:16,220 --> 00:15:19,160  
THAT CONFIRMS OUR PREFLIGHT  
NOTIONS, OUR PREENCOUNTER

262  
00:15:19,160 --> 00:15:22,999

NOTIONS AND WE'RE REALLY LOOKING  
FORWARD TO SEE HOW RAREFIED THAT

263

00:15:22,999 --> 00:15:23,999

IS.

264

00:15:23,999 --> 00:15:28,699

IT MAY BE THERE'S A THIN  
NITROGEN LAYER IN THE ATMOSPHERE

265

00:15:28,699 --> 00:15:32,829

OR METHANE OR OTHER CONSTITUENT,  
BUT IT MUST BE VERY TENUOUS

266

00:15:32,829 --> 00:15:34,480

COMPARED TO PLUTO.

267

00:15:34,480 --> 00:15:37,790

AGAIN, EMPHASIZING JUST HOW  
DIFFERENT THESE TWO OBJECTS ARE

268

00:15:37,790 --> 00:15:42,579

DESPITE THEIR CLOSE ASSOCIATION  
IN SPACE.

269

00:15:42,579 --> 00:15:46,370

ANOTHER PART OF ATMOSPHERIC  
SCIENCE IS NOW WE'VE GOT ON THE

270

00:15:46,370 --> 00:15:50,370

GROUND SOME OF THE RADIAL  
OCCUPATION DATA FOR PLUTO.

271

00:15:50,370 --> 00:15:53,949

A DEEP SPACE NETWORK TRANSMITTED  
A POWERFUL SIGNAL UP TO PLUTO

272

00:15:53,949 --> 00:15:57,439

TIMED TO ARRIVE WHEN THE  
SPACECRAFT WAS PASSING BEHIND

273

00:15:57,439 --> 00:16:00,769

THE PLANET SO WE COULD MEASURE  
THE REFRACTIVE INDEX OF THE

274

00:16:00,769 --> 00:16:01,769

ATMOSPHERE.

275

00:16:01,769 --> 00:16:06,449

AS YOU'LL HEAR FROM MIKE, WE GOT  
THE DATA, IT'S BEAUTIFUL DATA,

276

00:16:06,449 --> 00:16:08,860

AND THEY HAVE A WONDERFUL  
SCIENTIFIC SURPRISE.

277

00:16:08,860 --> 00:16:12,069

THE PRESSURE IN PLUTO'S  
ATMOSPHERE MEASURED AT THE BASE

278

00:16:12,069 --> 00:16:16,259

OF THE ATMOSPHERE FOR THE FIRST  
TIME IN HISTORY IS LOWER,

279

00:16:16,259 --> 00:16:18,180

SUBSTANTIALLY LOWER THAN  
PREDICTED.

280

00:16:18,180 --> 00:16:20,589

AND THAT'S PROBABLY TELLING US A  
STORY AND MIKE WILL HAVE MORE TO

281

00:16:20,589 --> 00:16:22,329

SAY ABOUT THAT.

282

00:16:22,329 --> 00:16:25,529

I'D LIKE TO CLOSE WITH ONE MORE  
TIME STEP.

283

00:16:25,529 --> 00:16:27,010  
THIS IS REALLY A SPECTACULAR

284  
00:16:27,010 --> 00:16:28,110  
IMAGE.

285  
00:16:28,110 --> 00:16:34,329  
THIS IS A SILHOUETTE OF PLUTO  
AFTER THE FLYBY.

286  
00:16:34,329 --> 00:16:38,119  
THIS IS OUR EQUIVALENT ON NEW  
HORIZONS OF THE APOLLO EARTH

287  
00:16:38,119 --> 00:16:41,300  
RISE PHOTOGRAPH THAT PROVES WE  
WERE THERE.

288  
00:16:41,300 --> 00:16:44,649  
YOU CAN ONLY GET THIS IMAGE BY  
GOING TO PLUTO AND CROSSING TO

289  
00:16:44,649 --> 00:16:46,709  
THE FAR SIDE AND LOOKING BACK.

290  
00:16:46,709 --> 00:16:51,709  
NOW AS STRIKING AND SPECTACULAR  
AS THIS IMAGE IS EMOTIONALLY, IT

291  
00:16:51,709 --> 00:16:55,589  
ALSO REPRESENTS A HUGE  
SCIENTIFIC DISCOVERY.

292  
00:16:55,589 --> 00:17:01,189  
YOU SEE ABOVE THE DARK DISK OF  
PLUTO THE BAND OF LIGHT WHICH IS

293  
00:17:01,189 --> 00:17:06,640  
TELLING US THAT PLUTO HAS A HAZE  
LAYER IN ITS ATMOSPHERE AND MIKE

294

00:17:06,640 --> 00:17:10,160

WILL TELL YOU MORE ABOUT IT.

295

00:17:10,160 --> 00:17:11,470

>> THANK YOU, ALAN.

296

00:17:11,470 --> 00:17:16,809

I'M GOING TO TALK ABOUT TWO NEW  
RESULTS THAT ARE BASICALLY

297

00:17:16,809 --> 00:17:19,390

CHANGING THE WAY WE THINK ABOUT  
PLUTO'S ATMOSPHERE.

298

00:17:19,390 --> 00:17:24,720

WE'RE STARTING FROM SCRATCH ON  
WHAT WE THOUGHT WE KNEW ABOUT

299

00:17:24,720 --> 00:17:27,449

THE ATMOSPHERE.

300

00:17:27,449 --> 00:17:32,470

MAY I HAVE THE FIRST TIME STEP  
PLEASE.

301

00:17:32,470 --> 00:17:35,110

THE FIRST GRAPHIC PLEASE.

302

00:17:35,110 --> 00:17:36,110

OKAY.

303

00:17:36,110 --> 00:17:41,240

THIS IS ONE OF OUR FIRST IMAGES  
OF PLUTO'S ATMOSPHERE.

304

00:17:41,240 --> 00:17:49,500

FOR 25 YEARS WE'VE KNOWN THAT  
PLUTO HAS AN ATMOSPHERE BUT IT'S

305

00:17:49,500 --> 00:17:51,190

BEEN KNOWN BY NUMBERS.

306

00:17:51,190 --> 00:17:54,910

THIS IS OUR FIRST PICTURE, THE  
FIRST TIME WE'VE REALLY SEEN IT.

307

00:17:54,910 --> 00:17:58,530

THIS WAS THE IMAGE THAT ALMOST  
BROUGHT TEARS TO THE EYES OF THE

308

00:17:58,530 --> 00:17:59,929

ATMOSPHERIC SCIENCE TEAM.

309

00:17:59,929 --> 00:18:04,029

COULD I HAVE THE NEXT STEP  
PLEASE.

310

00:18:04,029 --> 00:18:06,280

I WANT TO TELL YOU WHAT YOU'RE  
SEEING HERE.

311

00:18:06,280 --> 00:18:13,470

THIS IS THE ATMOSPHERE BACK LIT  
BY THE SUN AND IT'S LIVE

312

00:18:13,470 --> 00:18:17,200

SUNLIGHT SCATTERED BY SMALL  
PARTICLES IN THE ATMOSPHERE.

313

00:18:17,200 --> 00:18:20,230

THESE PARTICLES CONSTITUTE A  
HAZE LAYER.

314

00:18:20,230 --> 00:18:23,890

THE INSET IS A CROSS SECTION OF  
THAT HAZE LAYER SHOWING

315

00:18:23,890 --> 00:18:24,890  
STRUCTURE.

316  
00:18:24,890 --> 00:18:26,080  
THE COLORS HAVE BEEN ENHANCED.

317  
00:18:26,080 --> 00:18:27,419  
THEY'RE NOT REAL COLORS.

318  
00:18:27,419 --> 00:18:30,440  
JUST SO YOU COULD SEE THERE IS  
STRUCTURE.

319  
00:18:30,440 --> 00:18:33,750  
THERE IS AN ARGUMENT GOING ON IN  
THE TEAM, WHETHER IT'S DYNAMICS

320  
00:18:33,750 --> 00:18:34,750  
OR CHEMISTRY.

321  
00:18:34,750 --> 00:18:36,770  
IT'S PROBABLY BOTH.

322  
00:18:36,770 --> 00:18:40,899  
BUT THE REAL ANSWER IS THAT THIS  
IS OUR FIRST PEEK AT WEATHER IN

323  
00:18:40,899 --> 00:18:42,220  
PLUTO'S ATMOSPHERE.

324  
00:18:42,220 --> 00:18:43,220  
OKAY.

325  
00:18:43,220 --> 00:18:46,559  
COULD I HAVE THE NEXT TIME STEP  
TO ILLUSTRATE THAT MORE?

326  
00:18:46,559 --> 00:18:54,220  
THERE IS A HINT THAT THERE IS

EITHER A LAYER OF HAZE AT 30

327

00:18:54,220 --> 00:18:59,399

MILES, 50 MILES, OR A  
COMBINATION OF LAYERS AND WAVES

328

00:18:59,399 --> 00:19:01,049

IN THIS REGION.

329

00:19:01,049 --> 00:19:02,049

THOSE ARE THE KIND OF THING WES

330

00:19:02,049 --> 00:19:04,710

-- THINGS WE'RE GOING TO SORT  
OUT IN THE COMING WEEKS AND

331

00:19:04,710 --> 00:19:09,210

THOSE WILL TELL US THE DETAILS  
OF HOW THE ATMOSPHERE WORKS.

332

00:19:09,210 --> 00:19:13,080

HAZE IS EXTENSIVE AND SPINS AT  
LEAST 100 MILES ABOVE THE

333

00:19:13,080 --> 00:19:14,080

SURFACE.

334

00:19:14,080 --> 00:19:15,080

THAT IS A BIG SURPRISE.

335

00:19:15,080 --> 00:19:18,610

THAT'S FIVE TERMS FURTHER THAN  
OUR MODELS PREDICTED.

336

00:19:18,610 --> 00:19:21,141

MODELS PREDICTED THE HAZE  
PARTICLES WOULD FORM LOW IN THE

337

00:19:21,141 --> 00:19:24,940

ATMOSPHERE WHERE THE  
TEMPERATURES ARE COLD, BUT IT'S

338

00:19:24,940 --> 00:19:28,230

FORMING HIGH IN THE ATMOSPHERE  
WHERE THE TEMPERATURES ARE HOT,

339

00:19:28,230 --> 00:19:31,770

HOT FROM PLUTO'S PERSPECTIVE,  
WHICH IS NOT HOT TO OUR

340

00:19:31,770 --> 00:19:32,830

PERSPECTIVE.

341

00:19:32,830 --> 00:19:34,400

NONETHELESS, IT'S A MYSTERY.

342

00:19:34,400 --> 00:19:36,890

IT'S ONE OF THE THINGS WE'LL  
HAVE TO SORT OUT IN THE COMING

343

00:19:36,890 --> 00:19:37,940

DAYS.

344

00:19:37,940 --> 00:19:39,000

OKAY.

345

00:19:39,000 --> 00:19:40,840

THE HAZE IS PRETTY.

346

00:19:40,840 --> 00:19:42,140

IT'S A WAY TO SEE THE  
ATMOSPHERE.

347

00:19:42,140 --> 00:19:45,600

BUT IT'S A PIECE OF A BIG STORY  
THAT WE'RE TRYING TO UNDERSTAND

348

00:19:45,600 --> 00:19:46,600

FROM PLUTO.

349

00:19:46,600 --> 00:19:49,529

AND THAT IS HOW THE ATMOSPHERE  
AND THE SURFACES ARE CONNECTED.

350

00:19:49,529 --> 00:19:54,270

SO I HAD A SIMPLE ANIMATION TO  
ILLUSTRATE ONE ASPECT OF THAT

351

00:19:54,270 --> 00:19:55,270

CONNECTION.

352

00:19:55,270 --> 00:19:57,360

COULD I HAVE THE NEXT TIME STEP,  
PLEASE?

353

00:19:57,360 --> 00:19:58,360

OKAY.

354

00:19:58,360 --> 00:20:02,679

THIS SHOWS HOW METHANE IN THE  
UPPER ATMOSPHERE IS BROKEN APART

355

00:20:02,679 --> 00:20:06,980

BY ULTRAVIOLET RADIATION FROM  
THE SUN AND TO CHEMICAL

356

00:20:06,980 --> 00:20:10,480

COMBINES, RADICALS, SMALL AT  
TOMS AND MOLECULES THAT REACT

357

00:20:10,480 --> 00:20:13,010

TRIGGER SET OF CHEMICAL  
REACTIONS THAT FORM COMPLEX

358

00:20:13,010 --> 00:20:16,799

HYDROCARBONS LIKE ETHYLENE AND  
ACETYLENE, WHICH WERE DETECTED

359

00:20:16,799 --> 00:20:18,260  
BY NEW HORIZONS.

360

00:20:18,260 --> 00:20:22,370  
AS TIME GOES ON, THESE BUILD UP,  
THEY BECOME SUPER SATURATED AND

361

00:20:22,370 --> 00:20:27,200  
THEY SHOULD NUCLEATE TO FORM  
HAZE PARTICLES WHICH THEN GROW

362

00:20:27,200 --> 00:20:29,929  
AND EVENTUALLY THEY WILL GET BIG  
ENOUGH SO THAT YOU'LL SEE A HAZE

363

00:20:29,929 --> 00:20:32,440  
LAYER AND IT WILL FALL TO THE  
GROUND.

364

00:20:32,440 --> 00:20:37,049  
AT SOME POINT IN THIS CYCLE,  
THOSE HAZE PARTICLES ARE

365

00:20:37,049 --> 00:20:42,149  
CHEMICALLY PROCESSED TO PRODUCE  
WHAT WE CALL THOLENS, CHEMICALLY

366

00:20:42,149 --> 00:20:46,260  
ALTERED HYDROCARBONS THAT HAVE A  
RED COLOR, AND WE THINK THAT IS

367

00:20:46,260 --> 00:20:50,810  
HOW PLUTO'S SURFACE GOT ITS  
REDDISH HUE.

368

00:20:50,810 --> 00:20:53,190  
IN A MINUTE, KATHY WILL TALK  
MORE ABOUT THE COLOR AND KOCH

369

00:20:53,190 --> 00:20:54,940  
SITUATION OF THE SURFACE.

370  
00:20:54,940 --> 00:20:57,220  
THIS IS JUST ONE PIECE OF THAT  
STORY.

371  
00:20:57,220 --> 00:20:58,700  
IT'S NOT A COHERENT PIECE YET.

372  
00:20:58,700 --> 00:20:59,990  
THERE ARE SOME MYSTERIES.

373  
00:20:59,990 --> 00:21:03,880  
AS I SAID, WE DON'T UNDERSTAND  
WHY THERE'S A HAZE LAYER UP TO

374  
00:21:03,880 --> 00:21:06,100  
100 MILES ALTITUDE.

375  
00:21:06,100 --> 00:21:07,790  
IT REALLY IS A MYSTERY.

376  
00:21:07,790 --> 00:21:08,850  
OKAY.

377  
00:21:08,850 --> 00:21:11,950  
THE NEXT STORY REGARDS SURFACE  
PRESSURE.

378  
00:21:11,950 --> 00:21:14,140  
JUST GIVE YOU A LITTLE BIT OF  
CONTEXT HERE.

379  
00:21:14,140 --> 00:21:17,700  
UNTIL A PLANETARY ATMOSPHERE,  
THE SURFACE PRESSURE AT ANY

380  
00:21:17,700 --> 00:21:22,780

LEVEL IS A MEASURE OF THE WEIGHT  
OF THE AIR ABOVE THAT LEVEL.

381

00:21:22,780 --> 00:21:26,400

AND WEIGHT IS GRAVITY ACTING ON  
MASS.

382

00:21:26,400 --> 00:21:29,440

SO IF YOU KNOW THE SURFACE  
PRESSURE OF A PLANET'S

383

00:21:29,440 --> 00:21:32,860

ATMOSPHERE, YOU CAN GET A PRETTY  
GOOD ESTIMATE OF THE TOTAL MASS

384

00:21:32,860 --> 00:21:34,610

OF THAT ATMOSPHERE.

385

00:21:34,610 --> 00:21:38,059

AND IT'S IMPORTANT BECAUSE  
THAT'S A WAY OF QUANTIFYING THE

386

00:21:38,059 --> 00:21:40,320

GLOBAL STATE OF AN ATMOSPHERE.

387

00:21:40,320 --> 00:21:41,320

OKAY.

388

00:21:41,320 --> 00:21:45,530

SO IF I CAN HAVE THE NEXT  
GRAPHIC, PLEASE.

389

00:21:45,530 --> 00:21:47,309

OKAY.

390

00:21:47,309 --> 00:21:51,190

THIS SHOWS SURFACE PRESSURE ON  
PLUTO AS A FUNCTION OF TIME.

391

00:21:51,190 --> 00:21:53,190  
THE UNITS MIGHT BE A LITTLE  
STRANGE TO YOU.

392  
00:21:53,190 --> 00:21:54,559  
THEY'RE IN MICROBARS.

393  
00:21:54,559 --> 00:21:59,149  
A MICROBAR IS ONE MILLIONTH OF  
SEA LEVEL PRESSURE ON EARTH.

394  
00:21:59,149 --> 00:22:02,860  
AND THE TIME SCALE IS THERE SO,  
1989 UP TO JUST BEFORE THE

395  
00:22:02,860 --> 00:22:03,860  
PRESENT.

396  
00:22:03,860 --> 00:22:07,929  
NOW, WHAT IS INTERESTING HERE IS  
THAT 1-IN 1989 PLUTO WAS AT ITS

397  
00:22:07,929 --> 00:22:10,269  
CLOSEST DISTANCE TO THE SUN.

398  
00:22:10,269 --> 00:22:13,309  
AND NOW PLUTO IS MOVING AWAY  
FROM THE SUN IN ITS VERY

399  
00:22:13,309 --> 00:22:14,710  
ELLIPTICAL ORBIT.

400  
00:22:14,710 --> 00:22:18,630  
AS IT MOVES AWAY, IT SHOULD BE  
COOLING, THE NITROGEN SHOULD BE

401  
00:22:18,630 --> 00:22:22,169  
CONDENSING ONTO THE SURFACE, AND  
THE MASS SHOULD BE DECREASING,

402

00:22:22,169 --> 00:22:23,240

BUT WE DON'T SEE THAT.

403

00:22:23,240 --> 00:22:25,659

WE SEE THE EXACT OPPOSITE.

404

00:22:25,659 --> 00:22:29,220

THAT HAS BEEN VERY INTERESTING,  
NONETHELESS.

405

00:22:29,220 --> 00:22:31,710

WE HAVE BEEN TRYING TO FIGURE  
THIS OUT.

406

00:22:31,710 --> 00:22:35,190

WHAT I'M GOING TO SHOW YOU NOW  
IS A NEW DATA POINT, SOME MORE

407

00:22:35,190 --> 00:22:38,980

INFORMATION THAT WE HAVE TO ADD  
TO THIS STORY.

408

00:22:38,980 --> 00:22:44,029

IT IS JUST ONE DATA POINT, BUT I  
DO WANT TO SAY IT IS SIGNIFICANT

409

00:22:44,029 --> 00:22:45,600

AND WE ARE GOING TO HAVE TO  
FIGURE IT OUT.

410

00:22:45,600 --> 00:22:46,600

OKAY.

411

00:22:46,600 --> 00:22:47,600

SO THIS IS IT.

412

00:22:47,600 --> 00:22:50,960

THIS IS WHAT REX, THE RADIAL  
SCIENCE EXPERIMENT, HAS

413

00:22:50,960 --> 00:22:52,340

CONTRIBUTED TO THIS STORY.

414

00:22:52,340 --> 00:22:59,080

A NEW DATA POINT SHOWS THE  
PRESSURE IS AT MOST 10 MICROBAR,

415

00:22:59,080 --> 00:23:00,480

UPPER LIMIT.

416

00:23:00,480 --> 00:23:03,830

THE MASS, IF YOU WILL, OF  
PLUTO'S ATMOSPHERE, HAS CHANGED

417

00:23:03,830 --> 00:23:07,560

BY A FACTOR OF TWO, DECREASED BY  
A FACTOR OF TWO IN ABOUT TWO

418

00:23:07,560 --> 00:23:09,289

YEARS.

419

00:23:09,289 --> 00:23:12,899

THAT'S PRETTY ASTONISHING, AT  
LEAST TO AN ATMOSPHERIC

420

00:23:12,899 --> 00:23:13,899

SCIENTIST.

421

00:23:13,899 --> 00:23:14,899

THAT'S TELLING YOU SOMETHING IS  
HAPPENING.

422

00:23:14,899 --> 00:23:17,450

IT IS JUST ONE DATA POINT.

423

00:23:17,450 --> 00:23:18,710

THESE ARE EARLY RETRIEVALS.

424

00:23:18,710 --> 00:23:23,029

WE HAVE MORE DATA COMING AS ALAN  
SAYS, AND THERE'S MORE TO THE

425

00:23:23,029 --> 00:23:24,080

STORY.

426

00:23:24,080 --> 00:23:27,010

BUT IT'S ANOTHER MYSTERY THAT  
WE'RE GOING TO HAVE TO DEAL WITH

427

00:23:27,010 --> 00:23:31,669

OVER THE NEXT FEW WEEKS, MONTHS,  
YEARS, AND SO ON.

428

00:23:31,669 --> 00:23:32,669

OKAY.

429

00:23:32,669 --> 00:23:33,669

NOW I'M GOING TO TURN IT OVER  
THE KATRINA TY OLKIN, WHO'S

430

00:23:33,669 --> 00:23:35,480

GOING TO TALK ABOUT THE COLOR  
AND COMPOSITION OF PLUTO'S

431

00:23:35,480 --> 00:23:36,480

SURFACE.

432

00:23:36,480 --> 00:23:38,289

>> THANKS, MIKE.

433

00:23:38,289 --> 00:23:41,640

I'M GOING TO TELL YOU ABOUT THE  
COLOR AND COMPOSITION AND TRY TO

434

00:23:41,640 --> 00:23:45,600

TIE THIS TOGETHER SO YOU CAN  
UNDERSTAND WHAT WE KNOW FROM

435

00:23:45,600 --> 00:23:46,820

THIS COLOR.

436

00:23:46,820 --> 00:23:51,929

THE COLOR IS REALLY AN INDICATOR  
OF DIFFERENT COMPOSITIONAL

437

00:23:51,929 --> 00:23:52,929

UNITS.

438

00:23:52,929 --> 00:23:56,860

FIRST TIME STEP, THIS IS THAT  
SAME FALSE COLOR IMAGE ALAN

439

00:23:56,860 --> 00:23:57,860

SHOWED.

440

00:23:57,860 --> 00:24:01,250

I'LL SHOW YOU WHAT WE'RE SEEING  
SCIENTIFICALLY AND SOME OF THE

441

00:24:01,250 --> 00:24:05,940

THINGS WE KNOW AND UNDERSTAND  
FROM LOOKING AT THIS IMAGE.

442

00:24:05,940 --> 00:24:09,100

FIRST OF ALL, YOU CAN SEE THE  
DARK REGION DOWN AT THE BOTTOM

443

00:24:09,100 --> 00:24:10,100

OF THE IMAGE.

444

00:24:10,100 --> 00:24:11,269

THAT'S NEAR THE EQUATOR.

445

00:24:11,269 --> 00:24:12,539

THAT'S THE DARKEST REGION.

446

00:24:12,539 --> 00:24:16,780

IF YOU REMEMBER, THERE'S DARK  
REGIONS ALL AROUND THAT AREA,

447

00:24:16,780 --> 00:24:18,799

EVEN ON THE OTHER SIDE OF PLUTO.

448

00:24:18,799 --> 00:24:22,399

THEN JUST ABOVE IT, IT'S A  
LITTLE BIT BRIGHTER AND A LITTLE

449

00:24:22,399 --> 00:24:23,730

LESS RED.

450

00:24:23,730 --> 00:24:28,600

AND THEN AT THE NORTH POLE YOU  
SEE THE BRIGHT -- BRIGHTBRIGHTER.

451

00:24:28,600 --> 00:24:38,090

PUTTING THE LONGITUDE AND  
LATITUDE ON THE GRID HELPS YOU

452

00:24:38,090 --> 00:24:40,300

DRAW YOUR EYE TO THAT PATTERN.

453

00:24:40,300 --> 00:24:44,080

I WANT TO TALK ABOUT IT BECAUSE  
IT GOES TO THE COMPLEXITY THAT

454

00:24:44,080 --> 00:24:47,460

MIKE WAS JUST TALKING ABOUT,  
ABOUT THE ATMOSPHERE AND THE

455

00:24:47,460 --> 00:24:49,120

SURFACE AND THE INTERACTION.

456

00:24:49,120 --> 00:24:53,380

PLUTO HAS A VERY COMPLICATED  
SEASONAL PATTERN OF TRANSPORT OF

457

00:24:53,380 --> 00:24:59,200

ICES OVER -- IT TAKES 248 YEARS  
FOR PLUTO TO GO AROUND THE SUN.

458

00:24:59,200 --> 00:25:01,919

AND PLUTO HAS A VERY ECCENTRIC  
ORBIT.

459

00:25:01,919 --> 00:25:06,260

SO SOMETIMES IT'S MUCH CLOSER TO  
THE SUN THAN AT OTHER TIMES.

460

00:25:06,260 --> 00:25:10,130

ADDITIONALLY, PLUTO'S NORTH POLE  
IS TILTED OVER AT AN ANGLE OF

461

00:25:10,130 --> 00:25:14,980

ABOUT 120 DEGREES RELATIVE TO  
THE PLANE IT ORBITS IN.

462

00:25:14,980 --> 00:25:19,970

ALL OF THESE FACTORS TOGETHER  
CAUSE DIFFERENT PARTS OF PLUTO

463

00:25:19,970 --> 00:25:22,000

TO GET DIFFERENT AMOUNTS OF  
SUNLIGHT.

464

00:25:22,000 --> 00:25:26,169

AND THE SUNLIGHT IS POWERING THE  
SUBLIMATION OF THE ISLE ICES FROM THE

465

00:25:26,169 --> 00:25:28,320

SURFACE INTO THE ATMOSPHERE.

466

00:25:28,320 --> 00:25:33,169

SO SOME PARTS ARE KIND OF BAKED  
LIKE NEAR THE EQUATOR, AND OTHER

467

00:25:33,169 --> 00:25:37,799

PARTS RECEIVE THESE CONDENSATION  
OF THESE ICES AS YOU CAN SEE ON

468

00:25:37,799 --> 00:25:39,630

THE NORTH POLE HERE.

469

00:25:39,630 --> 00:25:42,350

AND SO WE'VE GOT A DIFFERING  
PATTERN THAT YOU CAN SEE

470

00:25:42,350 --> 00:25:47,490

MANIFESTED ON PLUTO THAT WE  
UNDERSTAND FROM MODELING OF THE

471

00:25:47,490 --> 00:25:50,460

SEASONAL TRANSPORT OF THESE  
ICES.

472

00:25:50,460 --> 00:25:53,519

BUT THERE'S ONE GLARING  
DIFFERENCE IN THIS PATTERN THAT

473

00:25:53,519 --> 00:25:57,010

I JUST CALLED OUT, AND THAT IS  
TOMBO REGGIO.

474

00:25:57,010 --> 00:25:58,870

NEXT TIME STEP, PLEASE.

475

00:25:58,870 --> 00:26:02,870

TOMBO REGGIO CLEARLY INTERRUPTS  
THIS PATTERN OF LATITUDE NAL

476

00:26:02,870 --> 00:26:07,130

VARIATION OF COLORS AND  
BRIGHTNESSES.

477

00:26:07,130 --> 00:26:14,399

ONE THING I SHOULD ATHD IS THOSE  
SH -- DARKER REGIONS ARE LIKELY

478

00:26:14,399 --> 00:26:17,260  
THE THOLENS THAT MIKE WAS  
DESCRIBING THAT WERE RAINING OUT

479

00:26:17,260 --> 00:26:26,580  
FROM THE HAZES OR FALLING FROM  
THE ATMOSPHERE AND THE HAZES.

480

00:26:26,580 --> 00:26:34,169  
WE'RE SEEING METHANE, CARBON  
ICES THERE.

481

00:26:34,169 --> 00:26:37,470  
ON THE NORTHERN PART OF PLUTO WE  
SEE METHANE AND NITROGEN BUT NOT

482

00:26:37,470 --> 00:26:39,039  
CARBON MONOXIDE.

483

00:26:39,039 --> 00:26:42,909  
SO MAYBE WHAT WE'RE SEEING IN  
TOMBO REGGIO IS A SOURCE REGION

484

00:26:42,909 --> 00:26:48,120  
FOR SOME OF THESE SPECIFIC ICES  
THAT COMPLICATES IN ADDITION THE

485

00:26:48,120 --> 00:26:51,809  
STORY OF THIS SEASONAL TRANSPORT  
THAT I WAS TELLING YOU ABOUT.

486

00:26:51,809 --> 00:26:54,409  
WE'RE GOING TO BE LOOKING AT  
THAT IN THE FUTURE.

487

00:26:54,409 --> 00:26:57,049  
AS YOU'VE HEARD, WE HAVE A SMALL

BIT OF OUR COMPOSITIONAL DATA

488

00:26:57,049 --> 00:27:00,360

DOWN, AND WE'LL GET A LOT MORE  
INFORMATION WHEN WE GET THE REST

489

00:27:00,360 --> 00:27:01,510

DOWN.

490

00:27:01,510 --> 00:27:04,690

BUT WE'VE GOT SOME GREAT IMAGES  
AND BILL McKINNON IS GOING TO

491

00:27:04,690 --> 00:27:09,029

TELL US ABOUT THE GEOLOGY OF  
THIS TOMBO REGGIO REGION AND

492

00:27:09,029 --> 00:27:10,419

NEARBY VICINITY.

493

00:27:10,419 --> 00:27:12,700

>> THANKS, KATHY.

494

00:27:12,700 --> 00:27:13,840

OKAY.

495

00:27:13,840 --> 00:27:18,830

CAN I HAVE MY FIRST GRAPHIC?

496

00:27:18,830 --> 00:27:24,809

NEXT, PLEASE.

497

00:27:24,809 --> 00:27:31,840

WE'LL BE LOOKING AT OUR FABULOUS  
NEAR ENCOUNTER HEMISPHERE.

498

00:27:31,840 --> 00:27:32,840

I KNOW YOU CAN SEE IT.

499

00:27:32,840 --> 00:27:34,299

YOU CAN START THE ANIMATION.

500

00:27:34,299 --> 00:27:38,850

AND WHAT WE HAVE NOW IS A FULL  
SEVEN FRAMES OF WHAT WILL

501

00:27:38,850 --> 00:27:42,950

ULTIMATELY BE A 12-FRAME MOSAIC  
AT HIGHER RESOLUTION BUT NOT

502

00:27:42,950 --> 00:27:45,600

EVEN OUR HIGHEST RESOLUTION THAT  
WILL COME DOWN LATER.

503

00:27:45,600 --> 00:28:00,460

THIS AREA AND THE NEXT SLIDE,  
NEXT, THIS AREA COVERS IN ITS

504

00:28:00,460 --> 00:28:08,130

ENTIRETY THIS VAST MORE OR LESS  
FLAT ICY PLANE.

505

00:28:08,130 --> 00:28:13,720

IT'S PRETTY BIG, ABOUT THE SIZE  
OF TEXAS.

506

00:28:13,720 --> 00:28:18,460

ALL AROUND THE PRIVILEGE FI AND  
IN THE INTERIOR ARE GEOLOGICAL

507

00:28:18,460 --> 00:28:21,880

WONDERS AND I'D LIKE TO SHARE  
SOME OF THOSE WONDERS WITH YOU.

508

00:28:21,880 --> 00:28:25,929

COULD I HAVE THE NEXT SLIDE,  
PLEASE?

509

00:28:25,929 --> 00:28:29,519  
SO FIRST I'D LIKE TO LOOK AT  
THAT ORANGE BOX, THE RECTANGLE

510  
00:28:29,519 --> 00:28:33,029  
THAT YOU SEE AT THE UPPER LEFT  
OF THE MOSAIC.

511  
00:28:33,029 --> 00:28:35,840  
NEXT SLIDE, PLEASE.

512  
00:28:35,840 --> 00:28:40,340  
THIS IS THE NORTHERN BOUNDARY OF  
SPLIT NICK PLANA.

513  
00:28:40,340 --> 00:28:43,330  
THERE'S A LITTLE SCALE BAR DOWN  
THERE, BUT BASICALLY THIS IS

514  
00:28:43,330 --> 00:28:48,460  
ABOUT 250 MILES ACROSS, ABOUT  
THE DISTANCE BETWEEN KANSAS

515  
00:28:48,460 --> 00:28:50,179  
CITY, MISSOURI, AND ST.

516  
00:28:50,179 --> 00:28:52,210  
LOUIS, A  
CITY WHICH I PICKED COMPLETELY

517  
00:28:52,210 --> 00:28:53,960  
AT RANDOM.

518  
00:28:55,960 --> 00:28:54,960  
OKAY.

519  
00:28:55,960 --> 00:28:57,110  
NEXT SLIDE.

520

00:28:57,110 --> 00:29:00,720  
I'VE MARKED SOME THINGS HERE TO  
HELP SORT OF GUIDE THIS TOUR.

521  
00:29:00,720 --> 00:29:14,259  
SO MOST OF THE PICTURE YOU SEE  
IS SPLITNIK PLANA.

522  
00:29:14,259 --> 00:29:16,550  
YOU CAN SEE THIS REALLY WELL AS  
YOU MOVE TO THE LEFT SIDE OF THE

523  
00:29:16,550 --> 00:29:19,580  
IMAGE WHERE THE CONTRAST BETWEEN  
THE BRIGHT AND DARK SHOWS UP.

524  
00:29:19,580 --> 00:29:23,259  
BUT AT THE TOP OF THE PICTURE  
IT'S REALLY DIFFERENT.

525  
00:29:23,259 --> 00:29:26,970  
THERE'S A RUGGED LANDSCAPE  
THERE, A DEGRADED LANDSCAPE,

526  
00:29:26,970 --> 00:29:29,340  
SOMETHING THAT TO A GEOLOGIST'S  
EYE LOOKS LIKE SOMETHING THAT

527  
00:29:29,340 --> 00:29:33,600  
HAS BEEN DEEPLY AND EXTENSIVELY  
ERODED.

528  
00:29:33,600 --> 00:29:36,210  
WE CAN TELL IT'S OLD AS WELL  
BECAUSE YOU CAN SEE WITH YOUR

529  
00:29:36,210 --> 00:29:40,250  
OWN EYE VARIOUS IMPACT CRATERS  
OF LARGE SIZE.

530

00:29:40,250 --> 00:29:45,100  
BUT WHAT'S REALLY INTERESTING TO  
US IS THE ACTUAL INTERACTION

531  
00:29:45,100 --> 00:29:49,230  
BETWEEN THE SPLITNIK PLANUM AND  
THE TERRAIN AT THE TOP.

532  
00:29:49,230 --> 00:29:54,460  
IF YOU LOOK CAREFULLY, YOU CAN  
SEE A PATTERN THAT INDICATES THE

533  
00:29:54,460 --> 00:30:01,210  
FLOW OF VISCOUS ICE TOWARDS THE  
CLIFF BOUNDARY ON THE RUGGED

534  
00:30:01,210 --> 00:30:02,210  
TERRAIN.

535  
00:30:02,210 --> 00:30:03,740  
WE CALL THESE STREAMLINES.

536  
00:30:03,740 --> 00:30:05,450  
WHEN YOU LOOK AT THESE  
STREAMLINES WHICH I'VE MARKED

537  
00:30:05,450 --> 00:30:10,080  
WITH THESE CURVED ARROWS YOU SEE  
THERE, THEY LOOK JUST LIKE, AND

538  
00:30:10,080 --> 00:30:14,140  
WE INTERPRET THEM TO BE JUST  
LIKE GLACIAL FLOW ON THE EARTH.

539  
00:30:14,140 --> 00:30:18,220  
I DON'T HAVE TO REMIND YOU THAT  
GLASHERS ON THE RERT MADE OF ICE

540  
00:30:18,220 --> 00:30:25,170  
LIKE IN ANTARCTIC AND GREENLAND,

AND WON'T MOVE ANYWHERE, IT'S

541

00:30:25,170 --> 00:30:27,289

IMMOBILE.

542

00:30:27,289 --> 00:30:32,620

ON PLUTO, THE KIND OF ICES WE  
THINK MAKE UP THE PLANUM, WHICH

543

00:30:32,620 --> 00:30:36,740

KATHY TALKED ABOUT, CARBON  
MONOXIDE ICE, NITROGEN ICE,

544

00:30:36,740 --> 00:30:41,230

METHANE ICE, THESE ICES ARE  
GEOLOGICALLY SOFT AND MALLEABLE

545

00:30:41,230 --> 00:30:45,820

EVEN AT PLUTO CONDITION, AND  
THEY WILL FLOW LIKE IN THE SAME

546

00:30:45,820 --> 00:30:47,951

WAY THAT GLACIERS DO ON THE  
EARTH.

547

00:30:47,951 --> 00:30:52,830

WE HAVE ACTUAL EVIDENCE FOR  
BASICALLY RECENT GEOLOGICAL

548

00:30:52,830 --> 00:30:55,429

ACTIVITY.

549

00:30:55,429 --> 00:31:01,779

ONE MORE THING, ONE ARROW AT THE  
12:00 POSITION, WE CAN PROBABLY

550

00:31:01,779 --> 00:31:07,750

SEE A FLOW OF THIS, SOLID  
NITROGEN ICE FLOEING THROUGH A

551  
00:31:07,750 --> 00:31:11,830  
BREACH IN AN OLD IMPACT CRATER  
AND PARTIALLY FILLING IN THE

552  
00:31:11,830 --> 00:31:15,090  
INTERIOR OF THAT CRATER.

553  
00:31:15,090 --> 00:31:18,990  
LIKE KATHY SAID, WE KNEW THERE  
WAS NITROGEN ICE ON PLUTO FROM

554  
00:31:18,990 --> 00:31:19,990  
SPECTRA.

555  
00:31:19,990 --> 00:31:21,429  
WE'VE KNOWN THIS FOR YEARS.

556  
00:31:21,429 --> 00:31:24,870  
WE IMAGINED THAT NITROGEN WAS  
SUBLIMATING AND EVAPORAING IN

557  
00:31:24,870 --> 00:31:30,250  
ONE PLACE AND CONDENSING IN  
ANOTHER PLACE, BUT, YOU KNOW, WE

558  
00:31:30,250 --> 00:31:33,909  
SEE EVIDENCE FOR RECENT  
GEOLOGICAL ACTIVITY IS SIMPLY A

559  
00:31:33,909 --> 00:31:35,480  
DREAM COME TRUE.

560  
00:31:35,480 --> 00:31:38,570  
I WANT TO BACK UP JUST ONE  
LITTLE BIT AND SAY WHEN I SAY

561  
00:31:38,570 --> 00:31:40,590  
RECENT I DON'T NECESSARILY MEAN  
YESTERDAY.

562

00:31:40,590 --> 00:31:42,750

I MEAN GEOLOGICALLY RECENT.

563

00:31:42,750 --> 00:31:45,309

BUT THE APPEARANCE OF THIS  
TERRAIN, THE UTTER LACK OF

564

00:31:45,309 --> 00:31:48,830

IMPACT CRATERS ON THE SPUTNIK  
PLANUM TELLS US THAT THIS IS

565

00:31:48,830 --> 00:31:56,590

REALLY A YOUNG UNIT AND WE HAVE  
MODELS OF WHAT SMALL BELTS WOULD

566

00:31:56,590 --> 00:31:59,190

BE ON PLUTO AND THEY GIVE  
VARIOUS ANSWERS BUT THE BEST

567

00:31:59,190 --> 00:32:03,799

ONES IMPLY THAT THE ICES OF  
SPUTNIK PLANUM AND THE FLOW

568

00:32:03,799 --> 00:32:07,510

FEATURES WE SEE, I SHOULD POINT  
OUT THE CURVED ARROWS AT THE

569

00:32:07,510 --> 00:32:10,760

UPPER LEFT, WE CAN ACTUALLY SEE  
THEM GOING AROUND WHAT LOOK TO

570

00:32:10,760 --> 00:32:14,759

BE BARRIER ISLANDS, REALLY KIND  
OF CONCLUSIVE EVIDENCE.

571

00:32:14,759 --> 00:32:19,580

JUST TO GET BACK TO THE AGE, THE  
AGE IS ONLY A FRACTION OF THE

572

00:32:19,580 --> 00:32:23,070

TOTAL AGE OF THE SOLAR SYSTEM,  
PROBABLY NO MORE THAN A FEW TENS

573

00:32:23,070 --> 00:32:25,190

OF MILLIONS OF YEARS.

574

00:32:25,190 --> 00:32:28,759

WHAT WE KNOW ABOUT NITROGEN ICE,  
WHAT WE KNOW OR CAN

575

00:32:28,759 --> 00:32:31,269

THEORETICALLY ESTIMATE ABOUT THE  
HEAT FLOW COMING FROM THE

576

00:32:31,269 --> 00:32:35,889

INTERIOR OF PLUTO, THERE'S NO  
REASON WHY THIS CANNOT BE GOING

577

00:32:35,889 --> 00:32:37,340

ON TODAY.

578

00:32:37,340 --> 00:32:38,799

OKAY.

579

00:32:38,799 --> 00:32:41,740

SO LET'S GO TO THE NEXT TIME  
STEP.

580

00:32:41,740 --> 00:32:44,940

NOW WE'RE GOING TO GO DOWN TO  
THE BOTTOM OF SPUTNIK PLANUM

581

00:32:44,940 --> 00:32:50,470

THERE, AND LET'S BLOW THAT UP.

582

00:32:50,470 --> 00:32:55,919

THIS IS A VERY BUSY SCENE, OKAY,  
AND IT'S A BUILT BIGGER THAN THE

583

00:32:55,919 --> 00:32:57,919

ONE I JUST SHOWED YOU.

584

00:32:57,919 --> 00:33:00,510

THIS ONE'S ABOUT 400 MILES  
ACROSS, SO THAT'S LIKE TAKING A

585

00:33:00,510 --> 00:33:05,580

DRIVE FROM L.A. TO PHOENIX,  
ALTHOUGH IT'S A BIT COLDER.

586

00:33:05,580 --> 00:33:08,269

ANYWAY, NEXT TIME STEP, PLEASE.

587

00:33:08,269 --> 00:33:12,809

SO HERE ARE SOME THINGS --  
ACTUALLY AT THE TOP OF THE IMAGE

588

00:33:12,809 --> 00:33:15,559

YOU CAN STILL SEE SPUTNIK  
PLANUM.

589

00:33:15,559 --> 00:33:19,919

YOU CAN STILL SEE IT'S POLYGON  
AND AT THE VERY BOTTOM IS THIS

590

00:33:19,919 --> 00:33:24,789

ANCIENT BLACK HEAVILY CRATERED  
REGION WHICH WE'VE BEEN

591

00:33:24,789 --> 00:33:27,600

INFORMALLY CALLING CAZULU  
REGGIO.

592

00:33:27,600 --> 00:33:33,659

AT THE 3:00 POSITION ARE A GROUP  
OF MOUNTAIN BLOCKS WHICH WE

593

00:33:33,659 --> 00:33:38,750  
DISCOVERED LAST WEEK AND WE ALL  
INFORMALLY NAMED THAT A WELL.

594  
00:33:38,750 --> 00:33:42,610  
IN THIS PICTURE YOU CAN SEE KIND  
OF IN THE CENTER, ACTUALLY ABOVE

595  
00:33:42,610 --> 00:33:45,990  
IN THE CENTER AND TOWARDS THE  
LEFT ANOTHER RANGE OR

596  
00:33:45,990 --> 00:33:47,779  
ARRANGEMENT OF MOUNTAIN BLOCKS.

597  
00:33:47,779 --> 00:33:50,769  
AND THESE MOUNTAINOUS REGIONS,  
TWO OF THEM, ARE ACTUALLY

598  
00:33:50,769 --> 00:33:52,560  
SOMEWHAT SIMILAR.

599  
00:33:52,560 --> 00:33:55,220  
YOU MIGHT THINK THE ONES ON THE  
LEFT ARE DIFFERENT, BUT THAT'S

600  
00:33:55,220 --> 00:33:58,259  
JUST BECAUSE THE SUN IS HIGHER  
IN THE SKY WHEN THAT PICTURE WAS

601  
00:33:58,259 --> 00:34:00,950  
TAKEN SO YOU DON'T SEE THE  
SHADOWS QUITE AS PROMINENTLY.

602  
00:34:00,950 --> 00:34:04,110  
THE ARRANGEMENT AND APPEARANCE  
OF THESE MOUNTAINS IS SIMILAR

603  
00:34:04,110 --> 00:34:06,870  
FROM ONE REGION TO THE OTHER.

604

00:34:06,870 --> 00:34:10,800

WE'VE GIVE AN INFORMAL NAME TO  
THIS MOUNTAIN BLOCK AFTER SIR

605

00:34:10,800 --> 00:34:17,850

EDMOND HILLARY, FIRST SUMMITED  
EVEREST BACK IN 1953.

606

00:34:17,850 --> 00:34:21,350

THE SCIENTIFICALLY INTERESTING  
AND FASCINATING THING ABOUT THE

607

00:34:21,350 --> 00:34:26,370

PICTURE TO ME IS THAT THE  
SPUTNIK PLANUM ICE, MOBILE ICES,

608

00:34:26,370 --> 00:34:30,440

SEEM TO HAVE MOVED AND  
SURROUNDED AND BATHED THE

609

00:34:30,440 --> 00:34:31,440

MOUNTAINS.

610

00:34:31,440 --> 00:34:36,730

IN FACT, THEY SEEM TO COVER UP  
NOT JUST -- INVADE AROUND THE

611

00:34:36,730 --> 00:34:40,010

MOUNTAIN BLOCKS BUT THEY EXTEND  
ALL THE WAY DOWN AND THEY SEEM

612

00:34:40,010 --> 00:34:45,740

TO FORGET OUT JUST ONTO THE EDGE  
OF THE CAZULU REGGIO.

613

00:34:45,740 --> 00:34:49,670

WHEN YOU LOOK AT IT IN DETAIL  
THERE'S A LOT OF FINE STRUCTURE

614  
00:34:49,670 --> 00:34:56,430  
IN THE ICE BETWEEN THE TWO AND A  
LOT OF FINE STRUCTURE THAT IS

615  
00:34:56,430 --> 00:35:00,460  
DIFFERENT THAN THE DIFFERENT  
SCALE, FINER SCALE THAN THE

616  
00:35:00,460 --> 00:35:02,350  
POLYGONS WE SEE THROUGHOUT.

617  
00:35:02,350 --> 00:35:06,260  
THAT TELLS US THAT THE ICE IN  
THAT INTERVENING REGION BETWEEN

618  
00:35:06,260 --> 00:35:10,140  
THE MOUNTAINS AND CAZULU IS  
SUBSTANTIALLY THINNER.

619  
00:35:10,140 --> 00:35:13,250  
ONE MORE FUN THING YOU CAN SEE,  
JUST AS YOU LOOK AT THE EDGE OF

620  
00:35:13,250 --> 00:35:24,120  
THE DARK UNIT, YOU SEE SORT OF  
CIRCLES OF BRIGHT MOBILE ICE.

621  
00:35:24,120 --> 00:35:29,350  
OKAY.

622  
00:35:29,350 --> 00:35:34,330  
SO LET'S PUT THIS ALL TOGETHER  
AND TAKE A FLYOVER FROM ONE END

623  
00:35:34,330 --> 00:35:37,610  
OF SPUTNIK PLANUM TO THE OTHER.

624  
00:35:37,610 --> 00:35:42,810  
WE'RE GOING TO START AT THE

NORTH.

625

00:35:42,810 --> 00:35:48,170

WE'RE GOING TO CAREEN OVER THE  
CLIFFS ON TO SPUTNIK PLANUM.

626

00:35:48,170 --> 00:35:59,520

THERE ARE THE ICE FLOES.

627

00:35:59,520 --> 00:36:03,761

THEY'RE STILL THERE BUT OBSCURED  
BY BRIGHTER ICES AND IT'S OUR

628

00:36:03,761 --> 00:36:06,580

APPROACHING THE REGION THAT IS  
SUPER RICH IN THE CARBON

629

00:36:06,580 --> 00:36:10,130

MONOXIDE THAT KATHY WAS JUST  
TALKING ABOUT.

630

00:36:10,130 --> 00:36:13,590

ANYWAY, IT'S A LONG FLIGHT ALL  
THE WAY TO THE SOUTH SO WE'LL

631

00:36:13,590 --> 00:36:19,210

SKIP OVER THAT PART AND WE'LL  
REJOIN OUR TOUR HERE COMING UP

632

00:36:19,210 --> 00:36:23,990

ON THE HILLARY MONTAY.

633

00:36:23,990 --> 00:36:26,160

BIG BLOCKS, SMALL BLOCKS AND  
BITS.

634

00:36:26,160 --> 00:36:34,900

THE CAZULU REGGIO, DARK ASPHALT  
CONE SURFACE.

635

00:36:34,900 --> 00:36:41,930

AS WE MOVE OVER THE HILLARY  
MONTES, THAT CRATER ITSELF IS

636

00:36:41,930 --> 00:36:43,780

ABOUT THE SIZE OF THE D.C.

637

00:36:43,780 --> 00:36:45,860

METRO  
AREA.

638

00:36:45,860 --> 00:36:59,100

AS WE MOVE OFF THE HILLARY  
MONTIES, THERE ARE THE NORGAY.

639

00:36:59,100 --> 00:37:04,020

THERE'S A WHOLE LOT MORE WE'RE  
GOING LEARN ABOUT PLUTO.

640

00:37:04,020 --> 00:37:09,380

JUST AS ALAN SAID AND JIM SAID,  
MOST OF OUR IMAGES, MOST OF OUR

641

00:37:09,380 --> 00:37:13,420

DATA ARE STILL ON THE SPACECRAFT  
OUTBOUND FROM PLUTO AND WE'LL BE

642

00:37:13,420 --> 00:37:17,510

DOWNLINK THIS IN THE MONTHS  
ALMOST A FULL YEAR OR MORE

643

00:37:17,510 --> 00:37:18,510

AHEAD.

644

00:37:18,510 --> 00:37:22,180

WITH THAT, BACK TO YOU, DUANE.

645

00:37:22,180 --> 00:37:24,170

>> THANK YOU.

646

00:37:24,170 --> 00:37:27,820

NOW WE'RE GOING TO TRANSITION  
INTO QUESTIONS, HIT THE PHONE

647

00:37:27,820 --> 00:37:32,280

LINES, SOCIAL MEDIA, AND COME  
BACK.

648

00:37:32,280 --> 00:37:35,920

I'LL GIVE YOU THE FIRST QUESTION  
BECAUSE YOUR EXPRESSION, PRETTY

649

00:37:35,920 --> 00:37:39,030

COOL STUFF, RIGHT?

650

00:37:39,030 --> 00:37:42,040

>> AVIATION WEEK FOR  
DR.

651

00:37:42,040 --> 00:37:43,040

McKINNON.

652

00:37:43,040 --> 00:37:48,490

I HAVE QUESTIONS ABOUT A COUPLE  
THINGS I SAW IN THE NEW DISK

653

00:37:48,490 --> 00:37:51,030

IMAGE.

654

00:37:51,030 --> 00:37:58,390

IT LOOKS LIKE A COPYRIGHT OR  
JUST TO THE WEST OF THE PLANE.

655

00:37:58,390 --> 00:38:01,680

IT'S A BIG CRATER I GUESS WITH  
SOME CENTRIC CIRCLES.

656

00:38:01,680 --> 00:38:04,560

IF YOU HAVE ANY IDEA WHAT THAT MIGHT BE.

657

00:38:04,560 --> 00:38:08,270

THEN ALSO JUST TO CONTINUE ON THE ICE FLOES.

658

00:38:08,270 --> 00:38:13,250

DO YOU HAVE ELEVATION DATAS AS TO WHAT'S MAKING IT FLOW AND IS

659

00:38:13,250 --> 00:38:16,810

IT FLOWING DOWN INTO THE MOUNTAINS, THE PLANE HIGHER THAN

660

00:38:16,810 --> 00:38:20,030

THE MOUNTAINS?

661

00:38:20,030 --> 00:38:22,210

>> I THINK YOU'RE PROBABLY TALKING ABOUT THERE ARE SOME

662

00:38:22,210 --> 00:38:24,400

CIRCULAR FEATURES I DIDN'T PARTICULARLY POINT OUT IN THE

663

00:38:24,400 --> 00:38:31,250

FULL DISK IMAGE, AND TO THE WEST AND TO THE NORTH OF SPUTNIK

664

00:38:31,250 --> 00:38:36,930

PLANUM AND TOMBAUGH REGGIO ITSELF, AND THOSE ARE PROBABLY

665

00:38:36,930 --> 00:38:38,740

IMPACT CRATERS OF SOME SCALE.

666

00:38:38,740 --> 00:38:42,740

MAYBE 150 OR UP TO 250 KILOMETERS WIDE.

667

00:38:42,740 --> 00:38:46,590

SO SOME PARTS OF PLUTO ARE  
PROBABLY AT LEAST FUNDAMENTALLY

668

00:38:46,590 --> 00:38:47,990

ANCIENT.

669

00:38:47,990 --> 00:38:50,210

EVEN THOUGH THERE MAY BE ACTIVE  
GEOLOGICAL PROCESSES.

670

00:38:50,210 --> 00:38:53,300

>> THERE ARE A FEW WITH CENTRAL  
PEAKS.

671

00:38:53,300 --> 00:38:56,260

>> I THINK THE SCALE -- LOOKING  
AT THE BIG PICTURE OF PLUTO

672

00:38:56,260 --> 00:38:59,020

YOU'D BE REALLY LOOKING AT VERY  
DISTINCT --

673

00:38:59,020 --> 00:39:02,370

>> I THINK HE WAS THINKING OF  
THE ONE WE INFORMALLY CALLED

674

00:39:02,370 --> 00:39:03,580

ELLIOTT CRATER.

675

00:39:03,580 --> 00:39:07,060

YOU CAN SEE IT IN THIS IMAGE  
THERE.

676

00:39:07,060 --> 00:39:10,260

>> YOU MEAN THE ONE JUST UP AT  
THE 10:30 POSITION OFF THE EDGE?

677

00:39:10,260 --> 00:39:13,140

IS THAT THE ONE YOU MEAN OR --

>> YEAH.