



1
00:00:00,666 --> 00:00:03,666
[music playing]

2
00:00:16,266 --> 00:00:19,233
- LAURA IS ONE OF
OUR UP-AND-COMING,

3
00:00:19,233 --> 00:00:22,700
I WOULD SAY SUPERSTAR SCIENTISTS
IN THE EARTH SCIENCE DIVISION.

4
00:00:22,700 --> 00:00:25,300
CERTAINLY ONE OF
OUR YOUNGER SCIENTISTS.

5
00:00:25,300 --> 00:00:26,733
AND I CAN SAY THAT,
BECAUSE TO ME,

6
00:00:26,733 --> 00:00:29,533
ANYBODY WHO LOOKS--
ANYBODY WHO'S YOUNGER THAN 50

7
00:00:29,533 --> 00:00:32,100
LOOKS YOUNG TO ME, SO...

8
00:00:32,100 --> 00:00:34,033
LAURA'S BEEN WORKING
IN ATMOSPHERIC CHEMISTRY,

9
00:00:34,033 --> 00:00:37,300
AND SHE'S BEEN
A REAL CATALYST HERE

10
00:00:37,300 --> 00:00:39,833
IN LEVERAGING
A UNIQUE COLLABORATION

11
00:00:39,833 --> 00:00:42,100

WE HAVE WITH OUR FRIENDS
OVER HERE AT GOOGLE.

12
00:00:42,100 --> 00:00:44,333
THEY HAVE
A LIMITED LIABILITY CORPORATION

13
00:00:44,333 --> 00:00:46,366
CALLED H211,

14
00:00:46,366 --> 00:00:48,233
AND ONE OF THE CONSEQUENCES
OF THAT,

15
00:00:48,233 --> 00:00:49,866
OR ONE OF THE BENEFITS
OF THAT,

16
00:00:49,866 --> 00:00:51,466
IS THEY HAVE
AN ALPHA JET HERE,

17
00:00:51,466 --> 00:00:53,466
WHICH IS
AN OLD GERMAN MILITARY JET

18
00:00:53,466 --> 00:00:55,400
THAT THEY USE FOR--

19
00:00:55,400 --> 00:00:57,900
SOME OF THEIR BIG PLAYERS USE
FOR TRAINING PURPOSES.

20
00:00:57,900 --> 00:01:00,166
AND ONE OF THE SIDE BENEFITS

21
00:01:00,166 --> 00:01:02,166
OF HAVING THAT AIRPLANE
BASED HERE AT AMES

22

00:01:02,166 --> 00:01:05,133

IS WE GET TO HANG EARTH SCIENCE
INSTRUMENTS ON IT

23

00:01:05,133 --> 00:01:06,833

AND GO DO COOL STUFF.

24

00:01:06,833 --> 00:01:08,900

AND ONE OF THE COOLEST THINGS
WE'VE BEEN DOING

25

00:01:08,900 --> 00:01:12,333

WITH WELL OVER 100 FLIGHTS NOW
OVER THE PAST COUPLE OF YEARS

26

00:01:12,333 --> 00:01:15,800

IS WE FOUGHT--
FLY VERTICAL PATHS

27

00:01:15,800 --> 00:01:18,000

OVER INTERESTING PHENOMENA,

28

00:01:18,000 --> 00:01:19,866

AND SOME OF THE MOST INTERESTING
PHENOMENA, OF COURSE,

29

00:01:19,866 --> 00:01:23,766

IS MEASURING THE CARBON DIOXIDE
AND METHANE EMISSION

30

00:01:23,766 --> 00:01:25,266

IN THE ATMOSPHERE.

31

00:01:25,266 --> 00:01:27,933

AND THESE ARE TWO
OF THE PRIMARY CONTRIBUTORS

32

00:01:27,933 --> 00:01:29,600

TO CLIMATE CHANGE,

33

00:01:29,600 --> 00:01:32,666

AND SO UNDERSTANDING
WHAT IS HAPPENING VERTICALLY

34

00:01:32,666 --> 00:01:35,700

WHEN WE DO OUR DOWNWARD-LOOKING
SATELLITE OBSERVATIONS

35

00:01:35,700 --> 00:01:37,200

IS REALLY ESSENTIAL

36

00:01:37,200 --> 00:01:39,200

IN COMBINING THAT
WITH GROUND TRUTHING.

37

00:01:39,200 --> 00:01:43,933

AND SO LAURA'S ONE OF OUR,
NOT ONLY BEST SCIENTISTS

38

00:01:43,933 --> 00:01:46,633

IN EARTH SCIENCE, BUT SHE'S ONE
OF OUR MOST EXUBERANT.

39

00:01:46,633 --> 00:01:48,933

AND I THINK YOU'LL--
THAT WILL COME ACROSS TODAY.

40

00:01:48,933 --> 00:01:50,200

SO THE REASON I'M UP HERE REALLY

41

00:01:50,200 --> 00:01:53,433

IS I WAS TELLING JACOB THE STORY
OF HER PRESENTATION

42

00:01:53,433 --> 00:01:55,633

AT A PROJECT TAG MEETING
ON MONDAY.

43

00:01:55,633 --> 00:01:58,600
AND SHE MAY ACTUALLY SAY THIS
DURING THE PROCESS

44
00:01:58,600 --> 00:02:01,700
BUT SHE SAID THAT SHE REALLY,
YOU KNOW,

45
00:02:01,700 --> 00:02:04,300
LIKES FOREST FIRES
AND WILDFIRES.

46
00:02:04,300 --> 00:02:06,500
[laughter]
AND SO SHE IMMEDIATELY

47
00:02:06,500 --> 00:02:09,733
ABSORBED THE NICKNAME "BLAZE,"

48
00:02:09,733 --> 00:02:11,833
WHICH I THINK
IS QUITE APPROPRIATE HERE.

49
00:02:11,833 --> 00:02:15,300
SO LAURA RECEIVED HER PhD
FROM THE UNIVERSITY OF COLORADO

50
00:02:15,300 --> 00:02:17,833
IN ANALYTICAL
AND ATMOSPHERIC CHEMISTRY

51
00:02:17,833 --> 00:02:19,333
IN 1997.

52
00:02:19,333 --> 00:02:21,733
I CAN REMEMBER 1997.

53
00:02:21,733 --> 00:02:24,300
SO TODAY, SHE IS GOING TO TALK
ABOUT SOME OF THE RESEARCH

54

00:02:24,300 --> 00:02:26,433

SHE'S BEEN DOING WITH
THE AJAX MISSION, AS WE CALL IT.

55

00:02:26,433 --> 00:02:27,866

IT'S CALLED

56

00:02:27,866 --> 00:02:30,366

"UP IN THE AIR: METHANE
AND OZONE OVER CALIFORNIA."

57

00:02:30,366 --> 00:02:33,533

WITH NO FURTHER ADO,
BLAZE IRACI.

58

00:02:33,533 --> 00:02:36,533

[applause]

59

00:02:39,733 --> 00:02:41,066

- I THINK IT MAY BE
CLUMSY IRACI.

60

00:02:41,066 --> 00:02:43,200

HANG ON WHILE
I GET THE MIC FIXED.

61

00:02:43,200 --> 00:02:45,600

THAT'S A NEW NICKNAME.
I DON'T ANSWER TO IT YET.

62

00:02:45,600 --> 00:02:47,600

SO IF YOU HAVE QUESTIONS,
YOU HAVE TO SHOUT 'EM OUT

63

00:02:47,600 --> 00:02:49,066

A COUPLE OF TIMES
FOR ME TO REALIZE

64

00:02:49,066 --> 00:02:50,866
IT'S MY NEW NICKNAME.

65
00:02:50,866 --> 00:02:52,933
IT IS PRETTY COOL
THAT I GET TO STUDY ALL SORTS

66
00:02:52,933 --> 00:02:55,133
OF INTERESTING PHENOMENA
IN THE EARTH'S ATMOSPHERE,

67
00:02:55,133 --> 00:02:56,633
BUT SOMETIMES I FEEL
A LITTLE GUILTY

68
00:02:56,633 --> 00:02:58,533
BECAUSE I GET EXCITED
ABOUT THINGS UP IN THE AIR

69
00:02:58,533 --> 00:03:01,200
THAT ACTUALLY COME FROM PROBLEMS
HAPPENING DOWN ON THE SURFACE,

70
00:03:01,200 --> 00:03:03,166
SO I DO WANT TO APOLOGIZE
IN THE BEGINNING.

71
00:03:03,166 --> 00:03:05,466
I DON'T LOVE FOREST FIRES.

72
00:03:05,466 --> 00:03:08,366
I JUST LOVE THE POLLUTION
THAT THEY MAKE.

73
00:03:08,366 --> 00:03:10,433
SO WITH THAT DISCLAIMER,
I'M NOT A HORRIBLE PERSON.

74
00:03:10,433 --> 00:03:12,866
I'M JUST

A REALLY GEEKY SCIENTIST.

75

00:03:12,866 --> 00:03:16,200
BUT AS DR. BICAY SAID, WE HAVE
THIS REALLY NEAT COLLABORATION

76

00:03:16,200 --> 00:03:18,100
WITH AN ORGANIZATION
CALLED H211

77

00:03:18,100 --> 00:03:20,000
THAT ALLOWS US TO
DO SOMETHING THAT,

78

00:03:20,000 --> 00:03:21,833
REALLY, NO ONE ELSE IN THE
ATMOSPHERIC SCIENCE COMMUNITY

79

00:03:21,833 --> 00:03:23,200
GETS TO DO.

80

00:03:23,200 --> 00:03:24,700
SO I'M TOTALLY STOKED
TO TELL YOU ALL ABOUT IT.

81

00:03:24,700 --> 00:03:26,700
AND I WILL PROBABLY TALK
A LITTLE TOO FAST,

82

00:03:26,700 --> 00:03:28,733
SO PEOPLE DOWN IN THE FRONT
SHOULD SLOW ME DOWN,

83

00:03:28,733 --> 00:03:31,166
'CAUSE I CAN SEE THE PEOPLE
DOWN IN THE FRONT.

84

00:03:31,166 --> 00:03:33,666
ALL RIGHT, LET ME TELL YOU
WHAT WE'RE GONNA DO TODAY.

85

00:03:33,666 --> 00:03:35,400

I WANT TO TELL YOU A LITTLE BIT
ABOUT THE AJAX PROJECT

86

00:03:35,400 --> 00:03:37,200

AS AN INTRODUCTION,
AND THEN I'LL TELL YOU

87

00:03:37,200 --> 00:03:39,700

ABOUT THE INSTRUMENTATION
THAT WE CARRY ON THE ALPHA JET.

88

00:03:39,700 --> 00:03:42,766

I WANT TO TELL YOU JUST A LITTLE
BIT ABOUT THE EARTH'S ATMOSPHERE

89

00:03:42,766 --> 00:03:44,800

BECAUSE I'M NOT FAMILIAR WITH
ALL YOUR FACES

90

00:03:44,800 --> 00:03:47,466

AND I DON'T KNOW THAT ALL OF YOU
WILL KNOW ALL THE JARGON

91

00:03:47,466 --> 00:03:50,766

THAT I'M GONNA FIND MYSELF
USING, DESPITE MY BEST EFFORTS.

92

00:03:50,766 --> 00:03:52,600

THEN I WANNA TELL YOU ABOUT
THREE OF THE THINGS

93

00:03:52,600 --> 00:03:54,600

WE'VE BEEN LOOKING AT.
WE'VE BEEN LOOKING AT OZONE

94

00:03:54,600 --> 00:03:56,833

THAT'S BROUGHT DOWN
FROM THE UPPER ATMOSPHERE,

95

00:03:56,833 --> 00:03:58,433

WHERE WE LIKE IT TO BE

96

00:03:58,433 --> 00:04:01,200

BUT THAT CAN AFFECT THE AIR
QUALITY THAT PEOPLE BREATHE

97

00:04:01,200 --> 00:04:03,366

IN CERTAIN PARTS OF THE U.S.

98

00:04:03,366 --> 00:04:06,233

I ALSO WANT TO TELL YOU
ABOUT COWS AND THEIR METHANE,

99

00:04:06,233 --> 00:04:08,333

BECAUSE THAT'S ACTUALLY
AN INTERESTING

100

00:04:08,333 --> 00:04:11,566

AND UP-AND-COMING TOPIC
WHEN IT COMES TO CLIMATE CHANGE,

101

00:04:11,566 --> 00:04:13,266

AND IT GETS A GOOD GIGGLE,

102

00:04:13,266 --> 00:04:15,666

BECAUSE JUST IMAGINE
WHERE THE METHANE COMES FROM

103

00:04:15,666 --> 00:04:17,933

AND INSERT YOUR OWN
FAVORITE JOKE.

104

00:04:17,933 --> 00:04:19,933

AND THEN FOREST FIRES,
AND THIS IS THE PART

105

00:04:19,933 --> 00:04:21,300

WHERE MY EYES
ARE GONNA LIGHT UP,

106

00:04:21,300 --> 00:04:23,300
BECAUSE WE GOT SOME GREAT DATA
YESTERDAY AND LAST WEEK.

107

00:04:23,300 --> 00:04:25,100
SO I'M GONNA SHOW YOU
SOME REALLY FRESH DATA,

108

00:04:25,100 --> 00:04:27,133
AND I PROBABLY WON'T BE ABLE
TO ANSWER YOUR QUESTIONS

109

00:04:27,133 --> 00:04:29,000
ABOUT IT JUST YET,
BUT I GOTTA SHOW YOU THE DATA,

110

00:04:29,000 --> 00:04:31,466
'CAUSE IT'S REALLY COOL, AND THE
TEAM'S BEEN WORKING REALLY HARD.

111

00:04:31,466 --> 00:04:34,266
SO LET'S HOP RIGHT INTO IT.

112

00:04:34,266 --> 00:04:35,833
SO THIS ARRANGEMENT THAT WE HAVE

113

00:04:35,833 --> 00:04:38,666
HAS BEEN GOING ON
SINCE ABOUT 2008.

114

00:04:38,666 --> 00:04:41,966
AND WE GET TO PUT INSTRUMENTS
ONTO AN AIRCRAFT

115

00:04:41,966 --> 00:04:43,566
THAT CAN REACH 50,000 FEET,

116

00:04:43,566 --> 00:04:45,666

ALTHOUGH OUR INSTRUMENTS
AREN'T QUITE THAT ROBUST.

117

00:04:45,666 --> 00:04:48,066

THE AIRCRAFT FLIES FOR ABOUT
TWO TO TWO AND A HALF HOURS

118

00:04:48,066 --> 00:04:49,433

ON A FULL TANK OF FUEL,

119

00:04:49,433 --> 00:04:51,466

SO WE CAN GET MOST PLACES
IN CALIFORNIA.

120

00:04:51,466 --> 00:04:53,700

WE CAN REACH INTO NEVADA.

121

00:04:53,700 --> 00:04:55,266

AND THERE ARE LOTS
OF INTERESTING QUESTIONS

122

00:04:55,266 --> 00:04:56,766

THAT ALSO WE CAN ADDRESS

123

00:04:56,766 --> 00:04:58,433

BY GOING OUT
OVER THE PACIFIC OCEAN.

124

00:04:58,433 --> 00:05:00,500

SO WE'RE REALLY LOCATED
IN A GREAT SPOT,

125

00:05:00,500 --> 00:05:02,366

AND WE GET TO FLY, LIKE,
THREE OR FOUR TIMES A MONTH.

126

00:05:02,366 --> 00:05:03,833

I MEAN, IT'S AMAZING.

THE AMOUNT OF DATA

127

00:05:03,833 --> 00:05:05,400
THAT WE'VE BEEN COLLECTING
IS REALLY ASTOUNDING.

128

00:05:05,400 --> 00:05:07,400
AND TO BE DOING IT
FOR SEVERAL YEARS IN A ROW

129

00:05:07,400 --> 00:05:09,266
IS REALLY A FANTASTIC
OPPORTUNITY.

130

00:05:09,266 --> 00:05:11,100
THE CREW THAT WE WORK WITH,

131

00:05:11,100 --> 00:05:13,233
SCIENCE TEAM
AND AIRCRAFT PERSONNEL,

132

00:05:13,233 --> 00:05:14,866
ARE JUST SUPER DEDICATED,

133

00:05:14,866 --> 00:05:16,633
AND YOU'LL SEE THAT
IN THE DATA THAT WE GET.

134

00:05:16,633 --> 00:05:17,866
IT'S AN AMAZING AMOUNT
OF DATA,

135

00:05:17,866 --> 00:05:20,000
AND THE TURNAROUND TIMES
ARE CRAZY.

136

00:05:20,000 --> 00:05:22,933
SO WE'RE ON A ROLL.
WE'RE FULLY CAFFEINATED.

137

00:05:22,933 --> 00:05:24,733

AND WE ARE SO EXCITED
ABOUT WHAT WE'RE DOING

138

00:05:24,733 --> 00:05:27,133

THAT I JUST REALLY WANT
TO SHARE IT ALL WITH YOU TODAY.

139

00:05:27,133 --> 00:05:29,433

SO THAT YOU UNDERSTAND
WHAT WE'RE DOING,

140

00:05:29,433 --> 00:05:32,200

LET ME SHOW YOU--
THIS IS OUR WING--OH, OKAY.

141

00:05:32,200 --> 00:05:34,766

SEE, I'VE ALREADY FORGOTTEN.
THAT'S THE AIRPLANE.

142

00:05:34,766 --> 00:05:38,033

AND YOU'LL NOTICE THAT IT'S
UNUSUAL IN THAT IT'S ASYMMETRIC.

143

00:05:38,033 --> 00:05:40,566

YOU SEE THERE'S TWO PODS ON
ONE SIDE AND ONE ON THE OTHER.

144

00:05:40,566 --> 00:05:43,033

YOU'RE LOOKING UP
UNDERNEATH THE AIRCRAFT.

145

00:05:43,033 --> 00:05:46,133

THE OUTBOARD PODS ARE FUEL.

146

00:05:46,133 --> 00:05:48,366

THE INBOARD ON WHAT IS
THE STARBOARD SIDE,

147

00:05:48,366 --> 00:05:50,800
ALTHOUGH YOU CAN'T TELL
FROM UNDERNEATH,

148
00:05:50,800 --> 00:05:53,866
YOU'LL SEE THERE'S
THREE BRIGHT, SHINY SPOTS.

149
00:05:53,866 --> 00:05:56,200
THAT'S THE UNDERSIDE
OF OUR SENSOR POD.

150
00:05:56,200 --> 00:05:59,033
THOSE BRIGHT, SHINY SPOTS ARE--
ACTUALLY ARE WINDOW PLATES,

151
00:05:59,033 --> 00:06:01,366
ALTHOUGH AT THE MOMENT, THEY
JUST HAVE GAS INLETS ON THEM.

152
00:06:01,366 --> 00:06:02,800
THEY DON'T HAVE GLASS
FOR OPTICAL MEASUREMENTS.

153
00:06:02,800 --> 00:06:05,333
SO THOSE THREE SHINY SPOTS
ARE THE DEAD GIVEAWAY.

154
00:06:05,333 --> 00:06:07,533
IF YOU SEE THIS FLYING OVERHEAD,
LOOK UP.

155
00:06:07,533 --> 00:06:09,233
SEE IF IT HAS THREE PODS ON IT.

156
00:06:09,233 --> 00:06:11,733
IF IT DOES,
IT'S DOING SCIENCE FOR US.

157
00:06:11,733 --> 00:06:13,966

ALL RIGHT,
THOSE THREE SHINY SPOTS--

158

00:06:13,966 --> 00:06:16,433
AND I'M GONNA PUT THE AIRCRAFT
RIGHT-SIDE UP AGAIN.

159

00:06:16,433 --> 00:06:18,733
HERE'S A SCHEMATIC DRAWING
FOR YOU IN THE BOTTOM.

160

00:06:18,733 --> 00:06:21,566
THE TAILFIN WILL GET YOU
ORIENTED.

161

00:06:21,566 --> 00:06:23,866
THE OTHER END IS THE NOSE
OF THE AIRCRAFT.

162

00:06:23,866 --> 00:06:25,633
STARTING FROM THE BACK,
SOME ELECTRONICS,

163

00:06:25,633 --> 00:06:28,400
IMPORTANT BUT NOT VERY EXCITING,
SAME WITH THE PUMP.

164

00:06:28,400 --> 00:06:30,533
BUT IN THE MIDDLE,
THE MAIN VOLUME

165

00:06:30,533 --> 00:06:32,266
THAT'S TAKEN UP IN THAT WING POD

166

00:06:32,266 --> 00:06:34,000
IS A GREENHOUSE GAS SENSOR.

167

00:06:34,000 --> 00:06:36,966
IT MEASURES CO2 AND METHANE,
AND WE ALSO GET WATER VAPOR

168

00:06:36,966 --> 00:06:39,200
FOR SOME CORRECTIONS.

169

00:06:39,200 --> 00:06:41,133
IN FRONT OF THAT
IS AN OZONE SENSOR.

170

00:06:41,133 --> 00:06:43,133
AND THEN TOWARDS THE FRONT,
SORT OF

171

00:06:43,133 --> 00:06:45,466
FROM WHERE IT STARTS TO CURVE
ALL THE WAY UP TO THE NOSE

172

00:06:45,466 --> 00:06:47,666
IS A METEOROLOGICAL MEASUREMENT
SYSTEM.

173

00:06:47,666 --> 00:06:49,666
AND I'LL GIVE YOU A LITTLE BIT
MORE INFORMATION

174

00:06:49,666 --> 00:06:51,333
ON EACH OF THESE,

175

00:06:51,333 --> 00:06:53,400
UNTIL I REALIZE
I'VE TALKED FOR WAY TOO LONG.

176

00:06:53,400 --> 00:06:55,200
BUT I THINK WE'RE OKAY.

177

00:06:55,200 --> 00:06:56,666
ALL RIGHT,
SO THE OZONE INSTRUMENT

178

00:06:56,666 --> 00:07:00,766

IS A COMMERCIAL, OFF-THE-SHELF,
STANDARD UV VISIBLE ABSORPTION--

179

00:07:00,766 --> 00:07:02,600
UV ABSORPTION TECHNIQUE.

180

00:07:02,600 --> 00:07:04,333
IT'S A DUAL CHANNEL,
ONE CHANNEL SCRUBBED

181

00:07:04,333 --> 00:07:07,366
AND ONE CHANNEL IS NOT,
AND IT'S CALIBRATED

182

00:07:07,366 --> 00:07:09,366
TO THE WORLD METEOROLOGICAL
ORGANIZATION SCALE,

183

00:07:09,366 --> 00:07:11,633
WHICH IS IMPORTANT WHEN
YOU'RE DOING THESE STUDIES

184

00:07:11,633 --> 00:07:13,400
THAT YOU WANT TO BE ABLE TO
SHARE DATA WITH OTHER GROUPS.

185

00:07:13,400 --> 00:07:15,033
IF YOU WANT YOUR DATA
IN CALIFORNIA

186

00:07:15,033 --> 00:07:17,100
TO BE COMPARABLE TO DATA
COLLECTED IN OTHER PLACES,

187

00:07:17,100 --> 00:07:18,500
YOU NEED TO GET BACK
TO A STANDARD.

188

00:07:18,500 --> 00:07:21,466
AND SO WE CALIBRATE BACK

TO THE WMO STANDARD ON OZONE.

189

00:07:21,466 --> 00:07:24,200

WE'VE COMPARED IT
AGAINST CHEMICAL--

190

00:07:24,200 --> 00:07:25,766

ELECTROCHEMICAL SONDES,

191

00:07:25,766 --> 00:07:27,666

WHICH ARE THE MOST
COMMONLY USED METHOD

192

00:07:27,666 --> 00:07:29,533

FOR MEASURING OZONE
IN THE ATMOSPHERE.

193

00:07:29,533 --> 00:07:32,266

NOAA HAS A SITE
IN NORTHERN CALIFORNIA

194

00:07:32,266 --> 00:07:33,966

THAT WE COMPARE TO.

195

00:07:33,966 --> 00:07:35,700

SO THIS INSTRUMENT'S BEEN
A REAL WORKHORSE FOR US,

196

00:07:35,700 --> 00:07:39,566

VERY RELIABLE, AND A VERY
IMPORTANT CHEMICAL TRACER.

197

00:07:41,266 --> 00:07:43,400

OUR GREENHOUSE GAS SENSOR
IS MANUFACTURED BY A COMPANY

198

00:07:43,400 --> 00:07:45,100

CALLED PICARRO.
THEY'RE ACTUALLY LOCAL,

199

00:07:45,100 --> 00:07:47,100

WHICH HAS BEEN FANTASTIC,
BECAUSE WE HAD TO MODIFY IT.

200

00:07:47,100 --> 00:07:49,033

IT'S BUILT 19 INCHES WIDE,

201

00:07:49,033 --> 00:07:51,066

LIKE ALMOST EVERY INSTRUMENT
IN THE WORLD IS BUILT.

202

00:07:51,066 --> 00:07:54,333

BUT THE WING POD
IS ONLY 12 INCHES WIDE.

203

00:07:54,333 --> 00:07:56,333

SO WE SPENT A LOT OF TIME
AND EFFORT

204

00:07:56,333 --> 00:07:58,333

AND ENGINEERING
AND CREATIVITY

205

00:07:58,333 --> 00:08:02,533

SQUEEZING THIS SQUARE THING
INTO A LONG RECTANGULAR SHAPE.

206

00:08:02,533 --> 00:08:05,100

SO HAVING PICARRO HANDY NEARBY

207

00:08:05,100 --> 00:08:07,400

WAS REALLY VERY USEFUL.

208

00:08:07,400 --> 00:08:09,600

SO ON THE BOTTOM THERE,
YOU CAN SEE THE GOLD REPACKAGING

209

00:08:09,600 --> 00:08:11,600

THAT WAS DONE TO TAKE THIS NICE

SQUARE INSTRUMENT

210

00:08:11,600 --> 00:08:13,166

AND PUT IT INTO A RECTANGLE

211

00:08:13,166 --> 00:08:15,166

THAT WILL JUST BARELY FIT
INTO THAT WING POD,

212

00:08:15,166 --> 00:08:18,066

AND SO IT OCCUPIES THE MAJORITY
OF THE VOLUME

213

00:08:18,066 --> 00:08:19,800

OF THAT STARBOARD WING POD.

214

00:08:19,800 --> 00:08:22,300

EACH OF THE TRACE GAS SENSORS
HAS AN INLET

215

00:08:22,300 --> 00:08:26,066

THAT HANGS DOWN BELOW
THE WING POD FOR DRAWING AIR IN.

216

00:08:26,066 --> 00:08:27,666

AND OUR MEASUREMENTS ARE MADE
IN REAL TIME,

217

00:08:27,666 --> 00:08:29,433

AND THEN THE AIR
IS EXHAUSTED OUT THE BACK.

218

00:08:29,433 --> 00:08:31,033

WE DON'T BRING ANY SAMPLES
HOME WITH US,

219

00:08:31,033 --> 00:08:33,066

JUST DATA FILES.

220

00:08:33,066 --> 00:08:34,966
AND THE METEOROLOGICAL
MEASUREMENT SYSTEM

221
00:08:34,966 --> 00:08:37,300
WE ADDED ABOUT A YEAR AGO,
AND IT'S FANTASTIC.

222
00:08:37,300 --> 00:08:38,966
IT'S FAST WINDS,

223
00:08:38,966 --> 00:08:40,500
THREE-DIMENSIONAL
WIND MEASUREMENTS.

224
00:08:40,500 --> 00:08:42,000
AND IT'S HARD, STILL,
FOR ME TO IMAGINE

225
00:08:42,000 --> 00:08:43,633
HOW THIS ACTUALLY HAPPENS,

226
00:08:43,633 --> 00:08:45,333
SO SEE IF YOU CAN IMAGINE.

227
00:08:45,333 --> 00:08:48,366
YOU'RE MOVING AT 300 KNOTS.

228
00:08:48,366 --> 00:08:51,600
AND YOU'RE MEASURING WIND SPEEDS
AT THE SAME TIME.

229
00:08:51,600 --> 00:08:54,366
PEOPLE FAR MORE CLEVER THAN I
HAVE FOUND A WAY TO DO THIS

230
00:08:54,366 --> 00:08:55,633
AND TO DO IT
WITH GREAT PRECISION.

231

00:08:55,633 --> 00:08:57,600

SO I CAN TELL YOU WHO TO TALK TO
IF YOU WANT TO KNOW

232

00:08:57,600 --> 00:08:59,500

HOW THIS WORKS,
BUT TRUST ME THAT IT DOES.

233

00:08:59,500 --> 00:09:01,433

WE GET WIND SPEEDS
IN ALL THREE DIRECTIONS--

234

00:09:01,433 --> 00:09:04,066

FRONTWARDS, SIDEWAYS,
AND UP AND DOWN,

235

00:09:04,066 --> 00:09:05,766

WHICH IS REALLY IMPORTANT
IF YOU WANT TO STUDY--

236

00:09:05,766 --> 00:09:08,666

SAY, YOU'RE DOWN NEAR A DAIRY,
AND YOU WANT TO KNOW

237

00:09:08,666 --> 00:09:10,666

IF YOUR METHANE IS COMING FROM
THE SLUDGE POND

238

00:09:10,666 --> 00:09:12,866

OR THE BARN OR FROM TOWN.

239

00:09:12,866 --> 00:09:14,600

YOU NEED TO KNOW WHICH WAY
THE WINDS ARE BLOWING.

240

00:09:14,600 --> 00:09:17,200

AND THEY CAN CHANGE ON
A VERY SHORT DISTANCE SCALE.

241

00:09:17,200 --> 00:09:20,200
SO IT'S REALLY FANTASTIC THAT
WE HAVE THIS HIGHLY ACCURATE

242
00:09:20,200 --> 00:09:22,333
AND VERY FAST MEASUREMENT
OF WINDS,

243
00:09:22,333 --> 00:09:25,033
AS WELL AS PRESSURE
AND TEMPERATURE.

244
00:09:25,033 --> 00:09:27,900
SO NOW THAT YOU KNOW
WHAT WE CAN MEASURE,

245
00:09:27,900 --> 00:09:29,200
LET ME TELL YOU
WHERE WE MEASURE IT.

246
00:09:29,200 --> 00:09:30,600
WE MEASURE IT
IN THE EARTH'S ATMOSPHERE.

247
00:09:30,600 --> 00:09:33,266
IN CASE YOU DON'T KNOW
THE EARTH'S ATMOSPHERE,

248
00:09:33,266 --> 00:09:35,100
'CAUSE MOST PEOPLE HERE DON'T,

249
00:09:35,100 --> 00:09:36,466
IT'S STARTS AT THE BOTTOM
HERE AT THE SURFACE,

250
00:09:36,466 --> 00:09:38,433
WHERE THE TEMPERATURE IS USUALLY
SOMETHING LIKE

251
00:09:38,433 --> 00:09:41,166

20 OR 25 DEGREES CELSIUS.

252

00:09:41,166 --> 00:09:43,433

I'M HOPING THAT'S A UNIT
THAT WORKS FOR MOST PEOPLE.

253

00:09:43,433 --> 00:09:45,766

AS YOU GO UP IN THE ATMOSPHERE,
IT GETS COOLER.

254

00:09:45,766 --> 00:09:47,633

YOU'VE PROBABLY NOTICED THIS IF
YOU GO UP IN THE MOUNTAINS

255

00:09:47,633 --> 00:09:50,433

OR IF YOU PUT YOUR HAND AGAINST
THE WINDOW IN AN AIRCRAFT.

256

00:09:50,433 --> 00:09:52,466

AND THE AIR CONTINUES TO COOL
AS YOU GET FARTHER AWAY

257

00:09:52,466 --> 00:09:54,700

FROM THE SURFACE OF THE EARTH,

258

00:09:54,700 --> 00:09:57,133

UNTIL AT SOME POINT--AND THAT
POINT'S CALLED THE TROPOPAUSE,

259

00:09:57,133 --> 00:09:59,566

AT SOME POINT THE TEMPERATURES
START TO CLIMB AGAIN

260

00:09:59,566 --> 00:10:01,466

AS YOU CONTINUE TO CLIMB
IN ALTITUDE.

261

00:10:01,466 --> 00:10:03,200

AND THAT'S THE YELLOW LINE
YOU'RE LOOKING AT THERE

262

00:10:03,200 --> 00:10:04,833
ON THE SCREEN.

263

00:10:04,833 --> 00:10:06,566
THAT TURNAROUND,
THAT TROPOPAUSE,

264

00:10:06,566 --> 00:10:08,600
IS THE PLACE
THAT SCIENTISTS DEFINE

265

00:10:08,600 --> 00:10:09,933
AS THE TOP OF THE TROPOSPHERE

266

00:10:09,933 --> 00:10:12,833
WHERE MOST OF THE MASS
OF THE ATMOSPHERE IS,

267

00:10:12,833 --> 00:10:16,033
WHERE WE BREATHE AND DO ALL
OF OUR DAILY BUSINESS,

268

00:10:16,033 --> 00:10:17,900
AND THE STRATOSPHERE,
WHICH LIVES ABOVE IT,

269

00:10:17,900 --> 00:10:19,800
WHICH IS AN INCREDIBLY STABLE
REGION OF THE ATMOSPHERE.

270

00:10:19,800 --> 00:10:21,933
IT'S VERY STRATIFIED,
BECAUSE THE AIR GETS WARMER,

271

00:10:21,933 --> 00:10:23,833
IT'S MORE BUOYANT,
THE FARTHER YOU GO UP.

272

00:10:23,833 --> 00:10:25,733
SO THERE'S NO REASON
FOR THAT AIR TO EVER TURN OVER,

273
00:10:25,733 --> 00:10:27,366
LIKE YOU WOULD SEE
IN A CONVECTIVE CLOUD

274
00:10:27,366 --> 00:10:29,200
DOWN HERE IN THE TROPOSPHERE.

275
00:10:29,200 --> 00:10:30,966
SO THOSE ARE THE TWO PIECES
OF THE ATMOSPHERE

276
00:10:30,966 --> 00:10:32,500
I'M GONNA TALK TO YOU ABOUT
TODAY.

277
00:10:32,500 --> 00:10:33,833
MOST OF THE TROPOSPHERE--

278
00:10:33,833 --> 00:10:35,733
ALL OF OUR FLIGHTS
ARE IN THE TROPOSPHERE.

279
00:10:35,733 --> 00:10:37,400
COMMERCIAL AIRLINERS GET UP
PRETTY CLOSE,

280
00:10:37,400 --> 00:10:39,500
DEPENDING ON YOUR LATITUDE,

281
00:10:39,500 --> 00:10:42,400
ESPECIALLY A LONG HAUL,
TO THE TROPOPAUSE.

282
00:10:42,400 --> 00:10:44,933
BUT FOR THE MOST PART, WEATHER
AND MOST EVERYTHING WE ALL KNOW

283

00:10:44,933 --> 00:10:47,000

ABOUT EVERY DAY
IS DOWN IN THE TROPOSPHERE HERE.

284

00:10:47,000 --> 00:10:49,600

THE STRATOSPHERE IS WHERE
THE OZONE LAYER IS.

285

00:10:49,600 --> 00:10:51,333

THAT'S UP AT ABOUT
20 TO 30 KILOMETERS.

286

00:10:51,333 --> 00:10:53,200

AND I'M GONNA KEEP CHANGING
UNITS ON YOU.

287

00:10:53,200 --> 00:10:55,133

I APOLOGIZE FOR THAT,

288

00:10:55,133 --> 00:10:56,600

BUT I LEARNED THE OZONE LAYER
IN KILOMETERS.

289

00:10:56,600 --> 00:10:58,933

SO IT'S AT ABOUT
20 TO 30 KILOMETERS.

290

00:10:58,933 --> 00:11:02,366

AND THAT'S WHERE
THE NATURAL OZONE EXISTS.

291

00:11:02,366 --> 00:11:05,800

IT'S GOT RELATIVELY HIGH
CONCENTRATIONS OF OZONE,

292

00:11:05,800 --> 00:11:08,466

BUT RELATIVELY HIGH IS STILL,
YOU KNOW,

293

00:11:08,466 --> 00:11:10,333

THINGS LIKE

.6 PARTS PER MILLION.

294

00:11:10,333 --> 00:11:11,833

BUT THAT'S ENOUGH OZONE

TO PROTECT US

295

00:11:11,833 --> 00:11:15,066

FROM ULTRAVIOLET RADIATION

FROM THE SUN.

296

00:11:15,066 --> 00:11:17,633

AND WE LIKE IT TO STAY UP THERE

AND PROTECT OUR DNA.

297

00:11:17,633 --> 00:11:19,700

BUT SOMETIMES, AND I'M GONNA

SHOW YOU SOME FLIGHTS,

298

00:11:19,700 --> 00:11:21,800

THAT OZONE CAN BE BROUGHT DOWN

299

00:11:21,800 --> 00:11:24,333

WHERE IT CAN MIX IN WITH THE AIR

THAT WE BREATHE.

300

00:11:24,333 --> 00:11:27,300

WE ALSO GENERATE

A LOT OF OZONE OURSELVES.

301

00:11:27,300 --> 00:11:29,066

AND I'LL TELL YOU A LITTLE BIT

MORE ABOUT THAT

302

00:11:29,066 --> 00:11:30,566

IN A LITTLE WHILE,

303

00:11:30,566 --> 00:11:32,300

BUT OZONE IS GREAT TO HAVE
BUT AWFUL TO BREATHE.

304

00:11:32,300 --> 00:11:34,666
JUST REMEMBER THAT.

305

00:11:34,666 --> 00:11:36,500
ALL RIGHT, I THINK THAT'S
EVERYTHING I WANTED TO TELL YOU.

306

00:11:36,500 --> 00:11:38,266
OH, AND THE VERY BOTTOM
OF THE ATMOSPHERE

307

00:11:38,266 --> 00:11:39,666
THE LOWEST PART OF THE
TROPOSPHERE

308

00:11:39,666 --> 00:11:42,733
IS CALLED THE PLANETARY BOUNDARY
LAYER OR THE MIXED LAYER.

309

00:11:42,733 --> 00:11:43,966
THAT'S THE AIR--

310

00:11:43,966 --> 00:11:45,700
HAVE YOU EVER NOTICED SOMETIMES
YOU'LL GET

311

00:11:45,700 --> 00:11:49,833
A VERY STILL LAYER AT NIGHTTIME?

312

00:11:49,833 --> 00:11:51,533
MAYBE YOU'LL GET A FOG TO FORM

313

00:11:51,533 --> 00:11:53,800
AND THAT'LL START TO MIX UPWARDS
IN THE MORNING

314

00:11:53,800 --> 00:11:55,366
WHEN THE SUN COMES UP
AND HEATS THE GROUND?

315
00:11:55,366 --> 00:11:57,500
THAT'S THE MIXED LAYER,
SO THE HEATING OF THE SURFACE

316
00:11:57,500 --> 00:11:59,333
OF THE EARTH IN THE MORNING

317
00:11:59,333 --> 00:12:02,700
MAKES THE MIXED LAYER DEEPER,
MORE CONVECTIVE,

318
00:12:02,700 --> 00:12:04,600
AND MAKES A TALLER LAYER

319
00:12:04,600 --> 00:12:06,933
WHERE PRETTY MUCH EVERYTHING
IN THAT BOTTOM LAYER

320
00:12:06,933 --> 00:12:10,966
IS UNIFORMLY MIXED JUST BY
THE MOTIONS OF THE ATMOSPHERE.

321
00:12:10,966 --> 00:12:12,900
AND DEPENDING ON WHERE YOU ARE
AND WHAT TIME OF YEAR

322
00:12:12,900 --> 00:12:15,000
AND HOW MUCH SUN YOU'VE HAD,
THAT CAN BE SOMETHING LIKE

323
00:12:15,000 --> 00:12:16,566
500 FEET THICK,

324
00:12:16,566 --> 00:12:19,533
OR IT CAN BE MORE LIKE
7,000 FEET THICK,

325

00:12:19,533 --> 00:12:21,266

DEPENDING ON A LOT OF THINGS.

326

00:12:21,266 --> 00:12:23,266

AND SO WE LIKE TO MEASURE
IN THAT MIXED LAYER

327

00:12:23,266 --> 00:12:25,400

IF WE'RE TRYING TO UNDERSTAND
WHAT HUMANS ARE DOING DOWN HERE,

328

00:12:25,400 --> 00:12:27,333

BECAUSE THAT'S WHERE
ALL OF OUR POLLUTION

329

00:12:27,333 --> 00:12:31,466

GENERALLY STAYS TRAPPED
IN THE SHORT TERM.

330

00:12:31,466 --> 00:12:33,900

SO WHAT AM I GONNA TELL YOU
ABOUT TODAY?

331

00:12:33,900 --> 00:12:35,766

I KNOW NOT EVERYONE HERE
IS FROM CALIFORNIA,

332

00:12:35,766 --> 00:12:37,800

SO HERE'S A MAP OF CALIFORNIA.

333

00:12:37,800 --> 00:12:40,133

WE'RE RIGHT IN THE CENTER WHERE
ALL THOSE FLIGHTS ORIGINATE,

334

00:12:40,133 --> 00:12:42,433

SO RIGHT THERE AT THE BOTTOM
OF SAN FRANCISCO BAY.

335

00:12:42,433 --> 00:12:43,800

THE FIRST THING
I'LL TELL YOU ABOUT

336

00:12:43,800 --> 00:12:45,533

IS THE YELLOW FLIGHT TRACK.

337

00:12:45,533 --> 00:12:47,733

CAN YOU SEE THAT IT GOES INLAND
INTO THE CENTRAL VALLEY?

338

00:12:47,733 --> 00:12:49,900

IT GOES TO A TOWN CALLED MERCED.
IT'S NEARBY,

339

00:12:49,900 --> 00:12:53,133

AND THEY HAVE VERY FRIENDLY
AIR TRAFFIC CONTROLLERS.

340

00:12:53,133 --> 00:12:54,933

AND THEY LET US COME
TO THEIR AIRPORT

341

00:12:54,933 --> 00:12:56,400

AND MAKE A VERTICAL PROFILE,

342

00:12:56,400 --> 00:12:58,633

A SPIRAL DOWN FROM THE TOP
TO THE BOTTOM,

343

00:12:58,633 --> 00:13:00,833

TO MEASURE THE COMPOSITION
OF THE AIR

344

00:13:00,833 --> 00:13:03,966

AT ALL OF THE LEVELS
FROM ABOUT 27,000 FEET

345

00:13:03,966 --> 00:13:06,200

DOWN TO ABOUT 1,000 FEET.

346

00:13:06,200 --> 00:13:08,033

THEN WE GO OFFSHORE,

347

00:13:08,033 --> 00:13:10,033

AND YOU CAN SEE THE YELLOW LINE
GOES OFF OVER THE PACIFIC,

348

00:13:10,033 --> 00:13:11,833

AND WE DO THE EXACT SAME THING
AGAIN.

349

00:13:11,833 --> 00:13:13,700

THAT AIR SHOULD BE CLEANER,
RIGHT?

350

00:13:13,700 --> 00:13:15,166

IT HASN'T SEEN
THE CENTRAL VALLEY.

351

00:13:15,166 --> 00:13:17,433

IT HASN'T SEEN A BUNCH OF HUMANS
IN PROBABLY THREE OR FOUR,

352

00:13:17,433 --> 00:13:19,266

FIVE DAYS, DEPENDING ON HOW LONG
IT'S TAKEN IT

353

00:13:19,266 --> 00:13:21,200

TO COME ACROSS THE PACIFIC.

354

00:13:21,200 --> 00:13:23,400

LET ME TELL YOU, THOUGH,
IT'S NOT ALWAYS CLEAN.

355

00:13:23,400 --> 00:13:26,233

OFTEN IT'S JUST AS BAD,
AND SOME DAYS THE WIND REVERSES

356

00:13:26,233 --> 00:13:28,633
AND ALL THE CRUD FROM ONSHORE
BLOWS OUT OVER THE OCEAN.

357
00:13:28,633 --> 00:13:30,866
SO I MADE A MISTAKE--
AND THEY CALL A PROFILE

358
00:13:30,866 --> 00:13:33,433
A CLEAN BACKGROUND PROFILE
WHEN IT'S REALLY NOT,

359
00:13:33,433 --> 00:13:35,400
BUT WHAT I MEAN IS
IT'S OUT OVER THE OCEAN

360
00:13:35,400 --> 00:13:37,966
AND WE THOUGHT
IT SHOULD HAVE BEEN CLEAN.

361
00:13:37,966 --> 00:13:40,266
THEN I ALSO WANT TO TELL YOU
ABOUT THREE WILD--

362
00:13:40,266 --> 00:13:42,200
THEN I'LL TAKE YOU
ON THE PURPLE TRIP

363
00:13:42,200 --> 00:13:44,366
IF YOU CAN SEE THAT PURPLE
OR BLUE ONE DOWN THERE.

364
00:13:44,366 --> 00:13:46,400
THAT ONE GOES DOWN
TO SAN LUIS OBISPO,

365
00:13:46,400 --> 00:13:50,866
AND THAT WILL TAKE A LOOK AT
SOME DAIRY SOURCES OF METHANE.

366

00:13:50,866 --> 00:13:53,433
THEN WE'VE GOT THREE FIRES
TO SHOW YOU.

367
00:13:53,433 --> 00:13:55,666
THE WHITE ONE IS THE RIM FIRE
FROM LAST YEAR.

368
00:13:55,666 --> 00:13:57,433
I'M PRESUMING MOST OF YOU
HAVE HEARD ABOUT THAT,

369
00:13:57,433 --> 00:13:59,500
ESPECIALLY IF YOU'RE FROM
OUT WEST HERE.

370
00:13:59,500 --> 00:14:02,266
THAT WAS A BIG ONE IN--
VERY NEAR YOSEMITE.

371
00:14:02,266 --> 00:14:04,366
THIS YEAR WE'VE GOT
THE GREEN ONE.

372
00:14:04,366 --> 00:14:07,100
THAT WAS THE EL PORTAL FIRE,
WHICH IS MOSTLY CONTAINED.

373
00:14:07,100 --> 00:14:09,100
I FORGOT TO CHECK THIS MORNING.

374
00:14:09,100 --> 00:14:11,266
AND THE BIG, JUICY ONE
IS THE RED ONE.

375
00:14:11,266 --> 00:14:12,966
SO UP IN SHASTA COUNTY,

376
00:14:12,966 --> 00:14:14,700
THERE ARE TWO FIRES BURNING

RIGHT NOW--

377

00:14:14,700 --> 00:14:16,966

BALD AND EILER--

378

00:14:16,966 --> 00:14:19,066

AND SO WE WENT UP AND TOOK
A LOOK AT THOSE YESTERDAY.

379

00:14:19,066 --> 00:14:21,200

SO WHOO-HOO.

380

00:14:21,200 --> 00:14:23,833

ALL RIGHT, SO FIRST,
LET'S GO LOOK

381

00:14:23,833 --> 00:14:25,600

FOR SOME STRATOSPHERIC AIR
THAT'S BEEN PULLED DOWN.

382

00:14:25,600 --> 00:14:27,033

AND I'M GONNA CHECK MY TIME,

383

00:14:27,033 --> 00:14:29,266

'CAUSE I DON'T WANT TO RUN OUT.

384

00:14:29,266 --> 00:14:31,333

OKAY.

385

00:14:31,333 --> 00:14:34,300

SO THE FIRST PICTURE ON THE LEFT
SHOWS THE WING POD.

386

00:14:34,300 --> 00:14:37,233

SO THE OUTBOARD IS FUEL
AND THE INBOARD IS THE SENSORS.

387

00:14:37,233 --> 00:14:39,200

YOU CAN SEE

THE LITTLE NASA LOGO.

388

00:14:39,200 --> 00:14:40,600

THAT'S HOW YOU KNOW IT'S US.

389

00:14:40,600 --> 00:14:42,933

LOOKING OUT ACTUALLY
FROM THE BACK--

390

00:14:42,933 --> 00:14:44,433

SO THIS AIRCRAFT TAKES
TWO PILOTS--

391

00:14:44,433 --> 00:14:46,200

A FRONT SEATER
AND A BACKSEATER.

392

00:14:46,200 --> 00:14:48,233

THE BACKSEATER HAD A MOMENT
TO BREATHE,

393

00:14:48,233 --> 00:14:50,433

TOOK A PICTURE OUT THE WINDOW
LOOKING DOWN AT THE RUNWAY

394

00:14:50,433 --> 00:14:51,933

AT CASTLE AIRPORT IN MERCED,

395

00:14:51,933 --> 00:14:54,266

THE ONE WHERE I TOLD YOU WE DO
THESE VERTICAL PROFILES.

396

00:14:54,266 --> 00:14:55,833

SO THAT'S WHAT IT LOOKS LIKE
FROM THE BACKSEAT

397

00:14:55,833 --> 00:14:57,500

OF THE ALPHA JET, APPARENTLY.

398

00:14:57,500 --> 00:14:59,600
[whispers] I'VE NOT BEEN UP.

399

00:14:59,600 --> 00:15:01,866
THE RED FLIGHT TRACK IN THE
MIDDLE IS JUST TO REMIND YOU.

400

00:15:01,866 --> 00:15:03,433
IT'S THE SAME AS THE YELLOW ONE.

401

00:15:03,433 --> 00:15:06,733
WE'VE DONE THIS FLIGHT PROBABLY
20 OR 30 TIMES BY NOW.

402

00:15:06,733 --> 00:15:08,466
THEY'RE ALMOST ALWAYS
EXACTLY THE SAME,

403

00:15:08,466 --> 00:15:11,266
UNLESS AIR TRAFFIC CONTROL MAKES
US DO SOMETHING FUNNY.

404

00:15:11,266 --> 00:15:13,166
BUT THE DATA IS SHOWN
IN THE RIGHT PLOT.

405

00:15:13,166 --> 00:15:14,833
SO THAT ONE'S A LITTLE HARD
TO GET YOUR HEAD AROUND

406

00:15:14,833 --> 00:15:16,500
IF YOU'RE NOT EXPECTING IT.

407

00:15:16,500 --> 00:15:18,666
THE COLOR IS THE AMOUNT OF OZONE
THAT WAS MEASURED.

408

00:15:18,666 --> 00:15:21,133
ON THE GROUND IS LATITUDE
AND LONGITUDE.

409

00:15:21,133 --> 00:15:24,000

AND THEN THE THIRD DIMENSION
IN THAT PLOT IS ALTITUDE.

410

00:15:24,000 --> 00:15:27,733

SO YOU CAN SEE
THE TWO VERTICAL CORKSCREWS.

411

00:15:27,733 --> 00:15:30,000

THOSE ARE THE VERTICAL PROFILES.

412

00:15:30,000 --> 00:15:31,766

AND IT'S LIKE ONE OF
THOSE PICTURES

413

00:15:31,766 --> 00:15:34,166

THAT ONCE YOU FIGURE IT OUT,
IT'LL ALL MAKE SENSE.

414

00:15:34,166 --> 00:15:36,300

WHAT YOU CAN PROBABLY SEE,
ONCE IT MAKES SENSE TO YOU,

415

00:15:36,300 --> 00:15:38,533

IS THAT RED PLANE,

416

00:15:38,533 --> 00:15:40,700

THE RED SLICE OF OZONE

417

00:15:40,700 --> 00:15:42,366

IN BETWEEN BLUE ABOVE

418

00:15:42,366 --> 00:15:44,066

AND BLUE AND GREEN BELOW--

419

00:15:44,066 --> 00:15:46,466

SO RED IS THE HIGHEST AMOUNT
OF OZONE ON THAT PLOT.

420

00:15:46,466 --> 00:15:50,033

AND SO THERE'S A TONGUE OF OZONE
THAT'S BEEN PULLED DOWN IN

421

00:15:50,033 --> 00:15:53,233

AND LIVES BETWEEN TWO LAYERS
OF LESS OZONE.

422

00:15:53,233 --> 00:15:55,266

THAT'S WHAT WE'RE LOOKING FOR,
IN FACT.

423

00:15:55,266 --> 00:15:57,533

SO OVER THE COURSE OF THE YEAR
THAT WE'VE BEEN LOOKING AT--

424

00:15:57,533 --> 00:15:59,633

YOU KNOW, THE YEAR THAT
WE'VE MADE THESE MEASUREMENTS,

425

00:15:59,633 --> 00:16:03,066

WE'VE SEEN A RESPECTABLE HANDFUL
OF THESE PHENOMENA,

426

00:16:03,066 --> 00:16:06,066

AND WE'VE MADE FRIENDS
WITH FOLKS DOWNSTREAM.

427

00:16:07,666 --> 00:16:09,800

SO IF I SWITCH THE PROJECTION
FOR YOU NOW,

428

00:16:09,800 --> 00:16:11,133

HERE'S A PLAIN OLD MAP.

429

00:16:11,133 --> 00:16:13,966

AND YOU CAN PROBABLY SEE
THE BLACK FLIGHT PLAN,

430
00:16:13,966 --> 00:16:15,966
THE ONSHORE/OFFSHORE CIRCLES

431
00:16:15,966 --> 00:16:18,200
THAT'S STARTING TO LOOK FAMILIAR
TO YOU NOW.

432
00:16:18,200 --> 00:16:22,000
WHAT'S--THE COLORS BEHIND IT
IS OZONE FROM A CHEMICAL MODEL

433
00:16:22,000 --> 00:16:23,533
CALLED RAQMS.

434
00:16:23,533 --> 00:16:26,533
AND THAT MODEL IS PREDICTING
ORANGE AMOUNTS,

435
00:16:26,533 --> 00:16:28,300
HIGH AMOUNTS OF OZONE,

436
00:16:28,300 --> 00:16:31,000
ON THE DAY IN THE PLACE
THAT WE FLEW

437
00:16:31,000 --> 00:16:34,266
AND LESS OZONE
IN OTHER LOCATIONS.

438
00:16:34,266 --> 00:16:37,266
THE BOTTOM PLOT IS ALSO FROM
THE SAME CHEMICAL MODEL.

439
00:16:37,266 --> 00:16:40,300
YOU'VE GOT ALTITUDE ON
THE Y-AXIS, LIKE YOU'D EXPECT.

440
00:16:40,300 --> 00:16:42,566
THE X-AXIS IS LATITUDE WITH--

441

00:16:42,566 --> 00:16:44,200

[clears throat]

EXCUSE ME.

442

00:16:44,200 --> 00:16:45,733

WITH THE POLE

TOWARDS YOUR RIGHT

443

00:16:45,733 --> 00:16:47,666

AND THE EQUATOR

TOWARDS YOUR LEFT.

444

00:16:47,666 --> 00:16:49,700

THE COLOR IS OZONE AGAIN.

445

00:16:49,700 --> 00:16:52,466

SO NOW YOU CAN REALLY SEE

HOW THE RED AMOUNTS OF OZONE,

446

00:16:52,466 --> 00:16:55,500

THE 100/120 PARTS PER BILLION

OF OZONE UP IN THE STRATOSPHERE,

447

00:16:55,500 --> 00:16:58,066

ARE BEING PULLED DOWN

IN THAT TONGUE

448

00:16:58,066 --> 00:17:01,266

THAT'S STICKING DOWN RIGHT

TOWARDS OUR BLACK FLIGHT LINE.

449

00:17:01,266 --> 00:17:04,766

THAT'S THE TONGUE OF OZONE

OF STRATOSPHERIC AIR

450

00:17:04,766 --> 00:17:06,666

THAT'S BEEN PULLED DOWN

BY THE WEATHER SYSTEM.

451
00:17:06,666 --> 00:17:09,033
AND THAT'S EXACTLY WHAT WE SAW
WHEN WE FLEW.

452
00:17:09,033 --> 00:17:12,033
SO THIS IS REALLY
AN AMAZING COINCIDENCE

453
00:17:12,033 --> 00:17:15,400
BOTH IN TIME AND--
AND BY MEETING THE RIGHT PEOPLE

454
00:17:15,400 --> 00:17:17,666
AND--AND NETWORKING
IN THE SCIENTIFIC COMMUNITY

455
00:17:17,666 --> 00:17:20,833
OF MODEL AND DATA.

456
00:17:20,833 --> 00:17:24,533
SO WE SAID, "HEY,"
TO OUR FRIEND BRAD

457
00:17:24,533 --> 00:17:26,833
WHO RUNS THIS MODEL,
"HOW'D YOUR MODEL DO?"

458
00:17:26,833 --> 00:17:29,700
AND OUR DATA IS IN BLACK,

459
00:17:29,700 --> 00:17:32,966
AND TWO DIFFERENT TYPES
OF MODEL RUNS ARE IN RED.

460
00:17:35,633 --> 00:17:38,066
YOU CAN TELL THAT THE MODEL IS
ABSOLUTELY GETTING THE FEATURES

461
00:17:38,066 --> 00:17:41,300

BUT NOT AS NARROWLY,
NOT AS TIGHTLY,

462

00:17:41,300 --> 00:17:43,400
AND NOT TO THE MAGNITUDE.

463

00:17:43,400 --> 00:17:45,700
SO THE BLACK SPIKES OF OZONE

464

00:17:45,700 --> 00:17:49,000
THAT YOU SEE GOING UP
IN THE AIRCRAFT DATA

465

00:17:49,000 --> 00:17:50,800
ARE VERY NARROW

466

00:17:50,800 --> 00:17:52,766
AND THEY GO TO VERY HIGH AMOUNTS
OF OZONE.

467

00:17:52,766 --> 00:17:56,766
THE MODEL SMEARS THOSE OUT INTO
BROADER, SHORTER RED FEATURES

468

00:17:56,766 --> 00:17:58,500
ON THIS PLOT.

469

00:17:58,500 --> 00:18:00,433
SO WE'VE BEEN OFFERING OUR DATA
TO THE MODELERS

470

00:18:00,433 --> 00:18:02,766
TO SAY, "HEY, IF YOU WOULD LIKE
TO IMPROVE YOUR MODELS,

471

00:18:02,766 --> 00:18:05,100
HERE'S SOME REAL DATA IN THE
ATMOSPHERE THAT WE CAN OFFER."

472

00:18:05,100 --> 00:18:06,666
SO THAT'S BEEN A LOT OF FUN.

473

00:18:06,666 --> 00:18:08,733
WE'RE REALLY ENJOYING
THAT COLLABORATION.

474

00:18:08,733 --> 00:18:11,100
IT'S HELPING FOLKS IN PLACES
LIKE WYOMING AND NEVADA

475

00:18:11,100 --> 00:18:14,000
WHERE THESE TONGUES GET DRAWN
ALL THE WAY DOWN TO THE SURFACE.

476

00:18:14,000 --> 00:18:15,766
IT'S HELPING THOSE FOLKS

477

00:18:15,766 --> 00:18:18,366
TO BE ABLE TO MAKE THEIR CASE
TO THE EPA THAT THIS DAY

478

00:18:18,366 --> 00:18:20,800
WHEN MY MONITORS WENT OFF SCALE
IT WASN'T OUR FAULT.

479

00:18:20,800 --> 00:18:22,766
YOU COULD STOP ALL
OF OUR LOCAL EMISSIONS

480

00:18:22,766 --> 00:18:24,366
AND YOU'D STILL HAVE THIS OZONE

481

00:18:24,366 --> 00:18:25,900
THAT CAME DOWN
FROM THE STRATOSPHERE

482

00:18:25,900 --> 00:18:27,566
AND MADE OUR AIR QUALITY
HORRIBLE.

483

00:18:27,566 --> 00:18:29,400

PLEASE DON'T PENALIZE US.

484

00:18:29,400 --> 00:18:32,333

AND THERE'S AN APPEALS PROCESS
FOR THE STATES TO GO THROUGH

485

00:18:32,333 --> 00:18:33,966

WITH THE EPA

486

00:18:33,966 --> 00:18:35,566

AND ONE OF THESE DAYS, THE ONE
I JUST SHOWED YOU IN FACT,

487

00:18:35,566 --> 00:18:38,433

OUR DATA WAS USED IN ONE
OF THOSE PACKETS TO THE EPA

488

00:18:38,433 --> 00:18:40,066

ON BEHALF OF WYOMING,
TRYING TO APPEAL--

489

00:18:40,066 --> 00:18:44,366

"PLEASE DON'T PUNISH US.
THIS WAS NATURAL"--

490

00:18:44,366 --> 00:18:48,933

THEIR STATE OZONE
REGULATED LEVELS.

491

00:18:48,933 --> 00:18:50,266

SO THAT'S BEEN REALLY COOL.

492

00:18:50,266 --> 00:18:52,000

IT'S REALLY NICE TO BE ABLE
TO TAKE THIS DATA

493

00:18:52,000 --> 00:18:54,900

AND APPLY IT TO SOMETHING THAT
REAL PEOPLE ACTUALLY FEEL

494

00:18:54,900 --> 00:18:58,033

AND BREATHE AND THAT REALLY
IMPACTS PEOPLE'S LIVES.

495

00:18:58,033 --> 00:18:59,800

IT'S REALLY BEEN GREAT.

496

00:18:59,800 --> 00:19:03,933

IN ANOTHER WAY, WE GET TO GO
AND SNIFF AROUND CATTLE.

497

00:19:03,933 --> 00:19:06,933

THIS IS SOME DATA
THAT WE COLLECTED

498

00:19:06,933 --> 00:19:08,500

IN A CAMPAIGN CALLED COW-GAS.

499

00:19:08,500 --> 00:19:11,866

AND YES, AT NASA AND EVERYWHERE
IN THE SCIENTIFIC COMMUNITY

500

00:19:11,866 --> 00:19:14,466

WE WORK REALLY HARD
TO MAKE OUR ACRONYMS SPIFFY.

501

00:19:14,466 --> 00:19:16,666

THIS ONE ACTUALLY WORKS.

502

00:19:16,666 --> 00:19:18,466

IT'S--WHAT WAS IT?

503

00:19:18,466 --> 00:19:20,733

CALIFORNIA--

504

00:19:20,733 --> 00:19:23,133

OH, I CAN'T EVEN REMEMBER
HOW IT WORKED OUT.

505
00:19:23,133 --> 00:19:26,933
THE "W" WAS WINTERTIME
AND THE "C" IS CALIFORNIA,

506
00:19:26,933 --> 00:19:28,933
BUT IT WORKED OUT SO THAT
WE COULD CALL IT COW-GAS.

507
00:19:28,933 --> 00:19:31,566
BUT THE GOAL WAS TO GO
AND SEE WHAT'S UP WITH DAIRIES.

508
00:19:31,566 --> 00:19:36,400
DAIRY CATTLE AND MEAT CATTLE
BOTH PRODUCE METHANE

509
00:19:36,400 --> 00:19:38,833
FROM THEIR DIGESTIVE SYSTEM,
ALL RUMINANTS DO,

510
00:19:38,833 --> 00:19:40,133
BUT IT'S KNOWN THAT DAIRY CATTLE

511
00:19:40,133 --> 00:19:43,400
PRODUCE A SIGNIFICANT MORE--

512
00:19:43,400 --> 00:19:45,966
SIGNIFICANT AMOUNT MORE METHANE

513
00:19:45,966 --> 00:19:47,933
THAN MEAT CATTLE.

514
00:19:47,933 --> 00:19:51,266
AND OFTEN, DAIRY CATTLE
ARE KEPT IN A WAY

515

00:19:51,266 --> 00:19:53,200
WHERE THEIR WASTE IS COLLECTED,

516
00:19:53,200 --> 00:19:55,933
BECAUSE THEY'RE ALWAYS BROUGHT
BACK TO THE BARN FOR MILKING.

517
00:19:55,933 --> 00:19:58,166
THEY'RE NOT LET FREE RANGE,
GENERALLY,

518
00:19:58,166 --> 00:20:00,400
'CAUSE IT WOULD BE VERY HARD
TO COLLECT THEM UP TO MILK THEM.

519
00:20:00,400 --> 00:20:02,266
SO THEY'RE KEPT TOGETHER,
AND THEIR WASTES

520
00:20:02,266 --> 00:20:05,966
ARE THEREFORE COLLECTED TOGETHER
IN A BIG SLUDGE POND.

521
00:20:07,933 --> 00:20:10,033
GUESS WHERE THE METHANE
COMES FROM.

522
00:20:10,033 --> 00:20:12,466
SO THERE'S A LOT OF EFFORT

523
00:20:12,466 --> 00:20:14,300
TO UNDERSTAND THE EMISSIONS
OF METHANE.

524
00:20:14,300 --> 00:20:17,700
IT'S ABOUT 120 TIMES STRONGER,
GREENHOUSE GAS,

525
00:20:17,700 --> 00:20:19,500
THAN CARBON DIOXIDE IS.

526

00:20:19,500 --> 00:20:21,366

AND IT'S A PLACE,
IN THIS PARTICULAR INDUSTRY,

527

00:20:21,366 --> 00:20:22,766

YOU COULD IMAGINE,

528

00:20:22,766 --> 00:20:25,266

WHERE YOU COULD IMPLEMENT
A COLLECTION SYSTEM

529

00:20:25,266 --> 00:20:27,133

OR FIND A WAY TO MITIGATE
THAT EMISSION.

530

00:20:27,133 --> 00:20:29,633

SO KNOWING
WHAT WE'RE UP AGAINST

531

00:20:29,633 --> 00:20:31,600

IS REALLY MOST OF THE BATTLE.

532

00:20:31,600 --> 00:20:33,466

SO THERE ARE DIFFERENT
MEASUREMENTS OUT THERE.

533

00:20:33,466 --> 00:20:35,633

IT'S A NEW PLACE
TO BE STUDYING.

534

00:20:35,633 --> 00:20:39,600

SO WE JOINED THIS CAMPAIGN
LED BY A FELLA NAMED IRA LEIFER

535

00:20:39,600 --> 00:20:41,966

DOWN AT CAL POLY
SAN LUIS OBISPO.

536

00:20:41,966 --> 00:20:44,766
AND HE HAS TWO GROUND-BASED--

537
00:20:44,766 --> 00:20:46,833
ONE'S A CAR AND ONE'S AN RV--

538
00:20:46,833 --> 00:20:48,233
MOBILE LABORATORIES THAT MEASURE

539
00:20:48,233 --> 00:20:50,766
ALMOST ANY CHEMICAL COMPOUND
YOU COULD IMAGINE,

540
00:20:50,766 --> 00:20:52,633
ESPECIALLY ALL THE ONES THAT
COME OUT OF COWS

541
00:20:52,633 --> 00:20:54,633
AND HUMANS AND FOSSIL FUELS,

542
00:20:54,633 --> 00:20:56,566
AND HE MAPPED OUT--

543
00:20:56,566 --> 00:21:00,300
IF YOU CAN SEE THE TWO BARNS,
THE VERTICAL WHITE--

544
00:21:00,300 --> 00:21:02,300
CAN I USE THE MOUSE?
WILL THIS WORK?

545
00:21:02,300 --> 00:21:03,900
CAN YOU SEE THAT?
HEY!

546
00:21:03,900 --> 00:21:06,433
THE TWO BARNS,
HERE'S THE WASTE POND.

547

00:21:06,433 --> 00:21:07,900
AND THIS RED DOTTED LINE
IS THE PATH

548
00:21:07,900 --> 00:21:12,900
THAT THE MOBILE SENSORS
DROVE AROUND DURING THE DAY.

549
00:21:12,900 --> 00:21:15,566
SO DURING THE COURSE OF THE DAY,
THEY DROVE AROUND.

550
00:21:15,566 --> 00:21:18,066
THEY TOOK A VARIETY
OF DIFFERENT MEASUREMENTS--

551
00:21:18,066 --> 00:21:20,166
SOME UP LOOKING AT THE SUN,

552
00:21:20,166 --> 00:21:21,800
SOME COLLECTING AIR SAMPLES--

553
00:21:21,800 --> 00:21:24,100
AND THEN AROUND MIDDAY,
THE ALPHA JET CAME IN

554
00:21:24,100 --> 00:21:27,566
AND WE COLLECTED DATA
TO EXPLAIN THE AIR ABOVE.

555
00:21:29,533 --> 00:21:31,500
SO HERE'S AN OVERVIEW
OF OUR FLIGHT THAT DAY.

556
00:21:31,500 --> 00:21:34,666
WE STARTED AT MOFFETT FIELD
UP HERE.

557
00:21:34,666 --> 00:21:36,366
CAME DOWN THROUGH

THE CENTRAL VALLEY.

558

00:21:36,366 --> 00:21:37,766

WE WANTED TO GET A SENSE

559

00:21:37,766 --> 00:21:39,633

OF WHAT WAS GOING ON EVERYWHERE
ELSE IN THE REGION

560

00:21:39,633 --> 00:21:42,100

SO IF SOMETHING REALLY STRANGE
WAS HAPPENING IN THE AREA,

561

00:21:42,100 --> 00:21:44,166

WE WOULDN'T NECESSARILY WRONGLY
ATTRIBUTE IT TO THE DAIRY.

562

00:21:44,166 --> 00:21:46,000

SO WE TOOK A LOOK
ALONG THE CENTRAL VALLEY.

563

00:21:46,000 --> 00:21:47,933

THEN WE CAME OVER
TO SAN LUIS OBISPO

564

00:21:47,933 --> 00:21:50,066

AND TOOK A VERTICAL PROFILE.

565

00:21:50,066 --> 00:21:51,900

THEN WE WENT ALONG
THIS LITTLE VALLEY HERE

566

00:21:51,900 --> 00:21:53,866

OUT TO FIND SOME CLEAN AIR,

567

00:21:53,866 --> 00:21:56,266

AND THEN CAME BACK HOME.

568

00:21:56,266 --> 00:21:59,266

SO IF I SHOW YOU METHANE

569

00:21:59,266 --> 00:22:01,900

IN THIS COLOR SCHEME

WHERE RED IS HIGH METHANE

570

00:22:01,900 --> 00:22:04,600

AND BLUE IS LESS METHANE,

571

00:22:04,600 --> 00:22:06,433

YOU CAN SEE THERE WAS LESS

METHANE ABOVE

572

00:22:06,433 --> 00:22:09,133

AND A LOT MORE DOWN HERE

IN THE BOUNDARY LAYER,

573

00:22:09,133 --> 00:22:11,200

IN THE MIXED LAYER

WHERE ALL THE HUMAN

574

00:22:11,200 --> 00:22:13,800

AND ANIMAL EMISSIONS GET MIXED.

575

00:22:13,800 --> 00:22:15,566

HERE'S A PLOT OF IT IN--

WITH THE VERTICAL--

576

00:22:15,566 --> 00:22:18,466

JUST THE VERTICAL INFORMATION

577

00:22:18,466 --> 00:22:21,133

AND THE QUANTITY OF METHANE

ON THE X-AXIS.

578

00:22:21,133 --> 00:22:23,866

SO YOU CAN SEE THERE WAS

A NICE ENHANCED LAYER OF METHANE

579

00:22:23,866 --> 00:22:25,600
DOWN AT THE SURFACE.

580
00:22:25,600 --> 00:22:29,366
THE HIGHEST AMOUNT WAS FOUND
AT ABOUT 700 METERS,

581
00:22:29,366 --> 00:22:33,066
WHICH IS ABOUT 2,100 FEET,
ABOVE THE GROUND.

582
00:22:33,066 --> 00:22:34,933
SO THIS DATA IS NOW BEING
FOLDED INTO THE ANALYSIS WITH

583
00:22:34,933 --> 00:22:37,566
ALL OF THE OTHER INSTRUMENTS
AND ALL THE OTHER INVESTIGATORS

584
00:22:37,566 --> 00:22:39,466
WHO WERE PRESENT
FOR THAT CAMPAIGN.

585
00:22:39,466 --> 00:22:42,233
AND IT'S SERVING AS THE--
THE PRECURSOR CAMPAIGN

586
00:22:42,233 --> 00:22:44,800
FOR ANOTHER ONE,
A LARGER SCALE CAMPAIGN

587
00:22:44,800 --> 00:22:46,800
OF SIMILAR INSTRUMENTATION
GOING ON THIS SUMMER, ACTUALLY,

588
00:22:46,800 --> 00:22:48,500
CALLED COMEX.

589
00:22:48,500 --> 00:22:50,966
SO WE ARE WORKING WITH THIS TEAM

590

00:22:50,966 --> 00:22:53,933

TO COMBINE THE REGIONAL DATA
THAT AJAX WAS ABLE TO COLLECT

591

00:22:53,933 --> 00:22:56,266

WITH THE LOCAL DATA THAT
WAS COLLECTED ON THE GROUND

592

00:22:56,266 --> 00:22:59,700

AND KNOWING WHAT WAS HAPPENING
AT THE DAIRY THAT DAY

593

00:22:59,700 --> 00:23:02,600

BECAUSE THEY HAD A COLLABORATOR
WHO WAS DOING THINGS LIKE

594

00:23:02,600 --> 00:23:04,100

PUTTING THE COWS IN,
TAKING THE COWS OUT,

595

00:23:04,100 --> 00:23:07,066

STIRRING THE SLUDGE POND,
WASHING DOWN THE SURFACES,

596

00:23:07,066 --> 00:23:09,333

AND SO THERE'S GONNA BE A LOT
OF INTERESTING INFORMATION

597

00:23:09,333 --> 00:23:12,200

FROM THAT CAMPAIGN ABOUT
HOW ANIMAL HUSBANDRY PRACTICES

598

00:23:12,200 --> 00:23:14,866

COULD BE MODIFIED IN A WAY
THAT COULD HELP US

599

00:23:14,866 --> 00:23:17,433

REDUCE THE AMOUNT OF METHANE
EMITTED.

600

00:23:19,700 --> 00:23:22,566

ALL RIGHT, THIS IS
WHAT I'VE BEEN WAITING FOR.

601

00:23:24,433 --> 00:23:26,033

OKAY.

602

00:23:26,033 --> 00:23:28,833

FOREST FIRES EMIT
CARBON DIOXIDE.

603

00:23:28,833 --> 00:23:31,400

ANYTHING THAT BURNS
EMITS CARBON DIOXIDE,

604

00:23:31,400 --> 00:23:34,066

BUT THEY ALSO EMIT METHANE.

605

00:23:34,066 --> 00:23:36,066

AND THE RATIO OF METHANE
TO CARBON DIOXIDE

606

00:23:36,066 --> 00:23:37,800

THAT IS EMITTED
FROM FOREST FIRES

607

00:23:37,800 --> 00:23:39,933

IS A NUMBER THAT, YOU KNOW,
EVERYONE THINKS THEY KNOW,

608

00:23:39,933 --> 00:23:42,100

AND THEY PUT THAT NUMBER
INTO THEIR MODELS.

609

00:23:42,100 --> 00:23:44,333

WELL, IT'S NOT RIGHT,
AND IT'S NOT ONE ANSWER.

610

00:23:44,333 --> 00:23:47,100
AND SINCE METHANE IS SUCH
AN IMPORTANT GREENHOUSE GAS,

611
00:23:47,100 --> 00:23:49,366
IT'S SOMETHING THAT NEEDS TO BE
BETTER STUDIED,

612
00:23:49,366 --> 00:23:52,000
ESPECIALLY OUT HERE IN THE WEST
WHERE WE HAVE WILDFIRES.

613
00:23:52,000 --> 00:23:54,233
WILDFIRES ARE VERY DIFFERENT
FROM GRASS FIRES.

614
00:23:54,233 --> 00:23:56,033
THEY SMOLDER.
THEY LAST A LONG TIME.

615
00:23:56,033 --> 00:23:57,600
THEY CAN LAST WEEKS.

616
00:23:57,600 --> 00:24:00,200
I MEAN, THE RIM FIRE LASTED
OVER A MONTH.

617
00:24:00,200 --> 00:24:04,900
SO WE'VE BEEN SAMPLING WILDFIRES
WHENEVER THEY'RE CLOSE ENOUGH.

618
00:24:04,900 --> 00:24:07,366
LIKE I TOLD YOU, OUR RANGE
IS ONLY ABOUT 1,000 KILOMETERS.

619
00:24:07,366 --> 00:24:09,466
WE ONLY HAVE ABOUT TWO HOURS
OF FLIGHT TIME.

620
00:24:09,466 --> 00:24:11,133

SO WHENEVER THERE'S A FIRE
CLOSE ENOUGH,

621

00:24:11,133 --> 00:24:13,266
WE GO OUT AND TRY TO GET
MEASUREMENTS AROUND IT.

622

00:24:13,266 --> 00:24:15,033
AND IN FACT, THE RIM FIRE,
WE WERE FORTUNATE

623

00:24:15,033 --> 00:24:16,600
TO BE ABLE TO MEASURE TWICE--

624

00:24:16,600 --> 00:24:18,600
ONCE EARLY
WHEN IT WAS HOT AND FLAMING

625

00:24:18,600 --> 00:24:21,733
AND ONCE MUCH LATER
WHEN IT WAS A MORE TAME,

626

00:24:21,733 --> 00:24:23,800
NEARLY CONTAINED FIRE

627

00:24:23,800 --> 00:24:26,300
AND PROBABLY A LOT MORE
SMOLDERING COMBUSTION.

628

00:24:26,300 --> 00:24:28,533
WE ALSO HAVE A COLLABORATION
WITH A FELLOW

629

00:24:28,533 --> 00:24:30,666
AT SAN JOSÉ STATE,
PROFESSOR CRAIG CLEMENTS,

630

00:24:30,666 --> 00:24:33,166
WHO--WHOSE AREA OF EXPERTISE

631
00:24:33,166 --> 00:24:34,900
IS THE MICROMETEOROLOGY,

632
00:24:34,900 --> 00:24:38,266
THE WINDS AND THE WIND FIELDS
IN SMOKE PLUMES.

633
00:24:38,266 --> 00:24:42,400
SO HE'S ACTUALLY GOT AN AMAZING
SET OF INSTRUMENTATION

634
00:24:42,400 --> 00:24:45,166
AND THEY'RE ALL, LIKE,
FIRE TRAINED.

635
00:24:45,166 --> 00:24:47,200
THEY CAN ACTUALLY GO OUT
VERY CLOSE TO A FIRE

636
00:24:47,200 --> 00:24:49,066
AND SET UP THEIR EQUIPMENT

637
00:24:49,066 --> 00:24:51,466
AND MEASURE THE STRUCTURE
OF THE PLUME

638
00:24:51,466 --> 00:24:53,533
MUCH CLOSER THAN, YOU KNOW--

639
00:24:53,533 --> 00:24:55,633
THEY'RE EVEN ALLOWED INSIDE THE,
LIKE, FIREFIGHTER PERIMETER.

640
00:24:55,633 --> 00:24:58,300
SO THIS DATA--THESE PHOTOS

641
00:24:58,300 --> 00:25:01,700
ARE FROM A DAY THAT WE WENT
TO OVERFLY

642

00:25:01,700 --> 00:25:03,133

THEIR GROUND-BASED MEASUREMENTS.

643

00:25:03,133 --> 00:25:06,700

SO THESE PHOTOS WERE COLLECTED

644

00:25:06,700 --> 00:25:09,700

FROM THE HIGHWAY

NEAR THE RIM FIRE.

645

00:25:09,700 --> 00:25:12,466

SO I JUST WANT TO SHOW YOU

HOW BAD THAT REALLY WAS.

646

00:25:12,466 --> 00:25:14,933

I MEAN, THAT'S ACTUALLY

TRUE COLOR FROM WHAT I'M TOLD

647

00:25:14,933 --> 00:25:17,033

BY THE STUDENT

WHO TOOK THESE PHOTOS.

648

00:25:17,033 --> 00:25:18,800

THIS IS THE RIG

649

00:25:18,800 --> 00:25:21,200

WITH THE SCANNING LIDAR

ON THE BACK, THE WHITE.

650

00:25:21,200 --> 00:25:25,366

THIS IS THE SCANNING LIDAR

THAT GETS THE WIND SPEEDS.

651

00:25:25,366 --> 00:25:27,400

AND THEY LAUNCHED

WEATHER BALLOONS AS WELL

652

00:25:27,400 --> 00:25:30,300

TO GET VERTICAL PROFILES
OF PRESSURE AND TEMPERATURE

653

00:25:30,300 --> 00:25:32,066

AND WIND.

654

00:25:32,066 --> 00:25:33,800

SO THEN WE FLEW,

655

00:25:33,800 --> 00:25:35,866

AND I'M HOPING THESE PHOTOS

ARE COMING OUT PRETTY WELL.

656

00:25:35,866 --> 00:25:39,733

THIS IS, AGAIN, WHAT IT

LOOKS LIKE FROM THE ALPHA JET.

657

00:25:39,733 --> 00:25:41,766

YOU CAN SEE THE FIRE FRONT HERE

658

00:25:41,766 --> 00:25:44,533

AND THIS JUST INCREDIBLE

SMOKE PLUME.

659

00:25:47,733 --> 00:25:50,433

I THINK THIS IS PROBABLY

MY FAVORITE--

660

00:25:50,433 --> 00:25:54,200

YEAH, MY FAVORITE FIRE PHOTO.

[laughs]

661

00:25:54,200 --> 00:25:55,933

SO IT WAS JUST

REALLY INCREDIBLE.

662

00:25:55,933 --> 00:25:58,433

THIS WAS THE FIRST TIME

WE FLEW IT, EARLIER IN THE FIRE.

663

00:26:02,766 --> 00:26:05,133

AND THEN, BECAUSE OUR PILOTS
ARE SO AMAZING

664

00:26:05,133 --> 00:26:07,100

AND SO COOPERATIVE,
WE SAID TO THEM,

665

00:26:07,100 --> 00:26:09,600

"SO WE WANT TO MEASURE THE
SMOKE. GO AS CLOSE AS YOU DARE."

666

00:26:09,600 --> 00:26:12,566

AND I'M KIND OF,
YOU KNOW, SUMMARIZING.

667

00:26:12,566 --> 00:26:15,200

AND THEY SAID, "OKAY.
WE'LL SEE YOU IN TWO HOURS."

668

00:26:15,200 --> 00:26:17,066

AND SO WE HAD SHOWN THEM
THE MAPS,

669

00:26:17,066 --> 00:26:19,000

AND WE'D SHOWN THEM
WHAT WE KNEW, YOU KNOW,

670

00:26:19,000 --> 00:26:21,100

BUT THAT INFORMATION
IS A LITTLE BIT OLD.

671

00:26:21,100 --> 00:26:23,166

FIRES CAN CHANGE REALLY QUICKLY.

672

00:26:23,166 --> 00:26:25,233

SO THEY WENT OUT AND THEY WENT
AND DID A PERIMETER.

673

00:26:25,233 --> 00:26:26,700
AND THEY SAID, "OH, LOOK,
THERE'S SMOKE IN THAT VALLEY.

674
00:26:26,700 --> 00:26:28,833
I BET LAURA WANTS
TO SAMPLE THAT."

675
00:26:28,833 --> 00:26:30,600
AND THEY WENT OVER AND THEY GOT
A LITTLE BIT OF VALLEY.

676
00:26:30,600 --> 00:26:32,266
SO IT'S REALLY FANTASTIC,

677
00:26:32,266 --> 00:26:34,033
BECAUSE WE CAN SAY
TO OUR PILOTS--

678
00:26:34,033 --> 00:26:35,800
WE'VE BEEN WORKING WITH THEM NOW
FOR YEARS--

679
00:26:35,800 --> 00:26:37,733
WE CAN SAY, "THIS IS WHAT
WE THINK YOU'RE GONNA FIND,

680
00:26:37,733 --> 00:26:39,566
BUT THIS IS WHAT
WE REALLY WANT.

681
00:26:39,566 --> 00:26:41,500
SO IF YOU SEE SOMETHING
DIFFERENT THAN WE EXPECT,

682
00:26:41,500 --> 00:26:43,866
GO GET IT."
AND THEY DO, AND IT'S GREAT.

683
00:26:43,866 --> 00:26:45,533

SO THIS IS THE DATA
THEY CAME HOME WITH.

684
00:26:45,533 --> 00:26:48,133
SO THE BLUE,
THIS IS THE FLIGHT TRACK

685
00:26:48,133 --> 00:26:50,000
WITH CO2,

686
00:26:50,000 --> 00:26:51,433
THE MIDDLE IS METHANE,

687
00:26:51,433 --> 00:26:53,033
AND THEN ON THE RIGHT,
I'VE GOT FOR YOU,

688
00:26:53,033 --> 00:26:55,433
THE RATIO OF METHANE TO CO2.

689
00:26:55,433 --> 00:26:58,666
UNDERNEATH,
THESE LITTLE ORANGE PIXELS

690
00:26:58,666 --> 00:27:00,333
ARE THE MODIS HOT SPOTS.

691
00:27:00,333 --> 00:27:02,966
SO MODIS IS A SATELLITE
THAT MEASURES IN THE INFRARED.

692
00:27:02,966 --> 00:27:07,400
AND SO IT HAS A DATA PRODUCT
THAT WILL FIND PIXELS

693
00:27:07,400 --> 00:27:09,033
THAT IT BELIEVES ARE ON FIRE

694
00:27:09,033 --> 00:27:11,200

OR RECENTLY WERE ON FIRE,
AND IT MARKS THEM.

695

00:27:11,200 --> 00:27:13,433

AND SO THAT'S WHAT
THESE SPOTS ARE.

696

00:27:13,433 --> 00:27:16,233

AND THEN THIS IS THE IMAGE
THAT SHOWS THE SMOKE.

697

00:27:16,233 --> 00:27:18,733

I THINK THOSE ARE TRUE COLOR.

698

00:27:18,733 --> 00:27:21,966

SO HERE--
OH, THE BLUE DIDN'T WORK.

699

00:27:21,966 --> 00:27:25,666

IF YOU CAN SEE THE LIGHT BLUE
IN THE BOTTOM PANEL

700

00:27:25,666 --> 00:27:27,533

AS A FUNCTION OF TIME,

701

00:27:27,533 --> 00:27:29,066

YOU CAN SEE THE ALTITUDE
THAT WE FLEW.

702

00:27:29,066 --> 00:27:31,133

SO HERE'S THE TAKEOFF.

703

00:27:31,133 --> 00:27:33,500

UP HERE,
A LITTLE BIT OF TRANSIT,

704

00:27:33,500 --> 00:27:35,233

AND THEN AT MERCED,

705

00:27:35,233 --> 00:27:37,533
THEY DID THE REGULAR VERTICAL
PROFILE LIKE ALWAYS,

706

00:27:37,533 --> 00:27:39,733
JUST SO WE KNOW SORT OF WHAT THE
CLEAN ATMOSPHERE LOOKS LIKE

707

00:27:39,733 --> 00:27:41,100
THAT DAY.

708

00:27:41,100 --> 00:27:44,566
AND THEN THEY WENT OVER
AND FLEW THREE LEGS

709

00:27:44,566 --> 00:27:47,933
ACROSS SORT OF THE DOWNWIND EDGE

710

00:27:47,933 --> 00:27:49,666
OF THE EXCLUSION ZONE.

711

00:27:49,666 --> 00:27:53,000
AND SO THERE'S ACTUALLY THREE
ALTITUDES HERE IN THIS PLOT,

712

00:27:53,000 --> 00:27:55,133
AND YOU CAN KIND OF SEE THREE
LAYERS HERE

713

00:27:55,133 --> 00:27:56,900
IN THE GOOGLE EARTH PLOT.

714

00:27:56,900 --> 00:27:59,366
WHERE IT REALLY JUMPS OUT,
THOUGH, IS ON THIS BOTTOM LAYER.

715

00:27:59,366 --> 00:28:01,433
THIS IS THE LOWEST LAYER,
AND THAT'S WHERE THEY REALLY GOT

716

00:28:01,433 --> 00:28:03,533

DOWN INTO THE PLUME,
SO THE METHANE LEVELS JUMPED UP.

717

00:28:03,533 --> 00:28:05,633

AND I'M GONNA SHOW YOU THAT
ON THE NEXT PAGE.

718

00:28:05,633 --> 00:28:07,166

SO THAT'S WHAT THIS RED CIRCLE

719

00:28:07,166 --> 00:28:09,166

IS MEANT TO DRAW
YOUR ATTENTION TO.

720

00:28:09,166 --> 00:28:11,133

OZONE INCREASED IN THIS PLUME,

721

00:28:11,133 --> 00:28:12,666

WHICH IS WHAT I'VE GOT PLOTTED
IN BLACK.

722

00:28:12,666 --> 00:28:13,933

AND THIS IS THE SAME PLACE.

723

00:28:13,933 --> 00:28:16,000

THIS RED CIRCLE
IS THE SAME PLACE HERE.

724

00:28:16,000 --> 00:28:17,933

AND YOU'RE GONNA SEE THAT THESE
ARE GONNA LIGHT UP

725

00:28:17,933 --> 00:28:19,966

ON THE NEXT PAGE, TOO.

726

00:28:19,966 --> 00:28:21,900

SO HERE'S THE SAME RED CIRCLE.

727

00:28:21,900 --> 00:28:23,933

SO THIS IS THE ALTITUDE
PROFILE AGAIN.

728

00:28:23,933 --> 00:28:26,266

THIS TIME IT'S IN RED.
HERE'S METHANE.

729

00:28:26,266 --> 00:28:29,333

METHANE REALLY INCREASED
IN THE PLUME, AS DID CO₂,

730

00:28:29,333 --> 00:28:30,833

AND THIS IS THE RATIO,
IN THE GREEN

731

00:28:30,833 --> 00:28:33,966

ON THE TOP FOR THE NEXT
FEW TIMES YOU SEE THIS PLOT.

732

00:28:33,966 --> 00:28:38,033

THE GREEN PLOT ON THE TOP
IS THE RATIO OF METHANE TO CO₂.

733

00:28:38,033 --> 00:28:41,333

AND SO THE FIRE JUMPS RIGHT OUT
WITH A LOT OF METHANE.

734

00:28:44,033 --> 00:28:47,066

WELL, YOU MIGHT SAY, WHAT IS
THIS LITTLE SPIKE OVER HERE?

735

00:28:47,066 --> 00:28:49,466

WELL, THAT IS THE VALLEY
THAT THEY WENT INTO.

736

00:28:49,466 --> 00:28:51,233

THEY SAW A HAZY,
SMOKY-LOOKING VALLEY,

737

00:28:51,233 --> 00:28:55,266

AND THEY WENT OVER AND THEY TOOK
A LITTLE LOOK FOR US.

738

00:28:55,266 --> 00:28:57,266

AND IT'S ABOUT THE SAME RATIO,

739

00:28:57,266 --> 00:29:00,533

A LITTLE BIT LOWER RATIO
OF METHANE TO CO2.

740

00:29:00,533 --> 00:29:04,066

SO THAT AIR HAS PROBABLY
TRANSPORTED INTO THAT VALLEY

741

00:29:04,066 --> 00:29:06,100

RELATIVELY RECENTLY.

742

00:29:08,766 --> 00:29:10,966

BUT THEN WE WENT BACK
12 DAYS LATER.

743

00:29:10,966 --> 00:29:14,166

WE DID A SIMILAR
FLIGHT PATTERN--

744

00:29:14,166 --> 00:29:16,433

VERTICAL PROFILE OVER MERCED,

745

00:29:16,433 --> 00:29:19,266

AND THEN WE DID AN INSIDE
AND AN OUTSIDE RING.

746

00:29:19,266 --> 00:29:22,566

AND WHAT YOU'RE GONNA SEE
POP OUT ON THE DATA PLOTS--

747

00:29:22,566 --> 00:29:25,200

AGAIN, SORRY, METHANE

ON THE LEFT, CO2 ON THE RIGHT.

748

00:29:25,200 --> 00:29:28,866

WHAT YOU'RE GONNA SEE POP OUT
IS THIS SIDE OVER HERE,

749

00:29:28,866 --> 00:29:32,266

YOU'LL SEE THE OUTSIDE,
THE FARTHER DOWNSTREAM PLUME--

750

00:29:32,266 --> 00:29:33,833

THE SLIGHTLY OLDER PLUME--

751

00:29:33,833 --> 00:29:36,533

AND ALSO LOTS
OF THIS INNER PLUME.

752

00:29:36,533 --> 00:29:39,900

SO LET ME SHOW YOU
SOME OF THAT DATA.

753

00:29:39,900 --> 00:29:41,700

AGAIN, YOU CAN SEE
THESE THREE PLACES

754

00:29:41,700 --> 00:29:44,466

WHERE WE'RE GETTING
ENHANCED CO2 AND METHANE.

755

00:29:44,466 --> 00:29:46,666

THE FIRST ONE IS IN
THE SAN JOAQUIN VALLEY

756

00:29:46,666 --> 00:29:49,033

AT MERCED, WHERE WE DO
A VERTICAL PROFILE.

757

00:29:49,033 --> 00:29:51,300

AND THAT, FOR THE MOST PART,
WHAT YOU ARE SEEING THERE,

758

00:29:51,300 --> 00:29:54,633

IS THE INFLUENCE
OF THE LOCAL URBAN AREA.

759

00:29:54,633 --> 00:29:58,666

SO THE SAN JOAQUIN VALLEY
IS A PRETTY POLLUTED PLACE,

760

00:29:58,666 --> 00:30:01,033

AND WE CAN SEE THAT
PRETTY CLEARLY

761

00:30:01,033 --> 00:30:03,900

WHEN WE DO OUR VERTICAL PROFILE.

762

00:30:03,900 --> 00:30:07,300

WHAT'S INTERESTING SOMETIMES
IS WE CAN SOMETIMES SEE--

763

00:30:07,300 --> 00:30:09,333

IF THE BIOSPHERE IS VERY ACTIVE,

764

00:30:09,333 --> 00:30:12,333

WE CAN SOMETIMES SEE
A LITTLE DECREASE IN THE CO₂.

765

00:30:12,333 --> 00:30:14,500

I THINK I HAD THAT UP HERE.
YEAH.

766

00:30:14,500 --> 00:30:17,400

SO THIS LITTLE DECREASE IN CO₂
OF THE SAN JOAQUIN VALLEY

767

00:30:17,400 --> 00:30:20,633

IS PLANTS AND TREES PULLING CO₂
OUT OF THE ATMOSPHERE.

768

00:30:20,633 --> 00:30:24,000
AND SO THAT'S WHY THERE'S
ACTUALLY A LITTLE BIT LESS CO2,

769
00:30:24,000 --> 00:30:26,233
WHICH REALLY JACKS UP
THIS RATIO.

770
00:30:26,233 --> 00:30:28,566
[laughs]

771
00:30:28,566 --> 00:30:32,633
ALL RIGHT. WAIT A MINUTE,
I'M GOING THE WRONG WAY.

772
00:30:32,633 --> 00:30:35,133
THERE WE GO.
BUT THIS DAY WE DIDN'T.

773
00:30:35,133 --> 00:30:38,000
IN FACT, WE SAW JUST AS MUCH CO2

774
00:30:38,000 --> 00:30:40,166
OVER THE SAN JOAQUIN VALLEY

775
00:30:40,166 --> 00:30:42,600
AS WE DID OVER THE FIRE.

776
00:30:42,600 --> 00:30:44,700
AND AS IT TURNS OUT,
THE METEOROLOGY THAT DAY

777
00:30:44,700 --> 00:30:46,733
EXPLAINS IT ENTIRELY.
IT WAS A VERY STAGNANT DAY.

778
00:30:46,733 --> 00:30:48,433
THERE HAD BEEN DOWNSLOPE FLOW
THE NIGHT BEFORE

779

00:30:48,433 --> 00:30:50,300
AND EVERYTHING
WAS INCREDIBLY STILL.

780

00:30:50,300 --> 00:30:52,666
SO IT WAS HORRIBLE AIR QUALITY
IN THE SAN JOAQUIN VALLEY

781

00:30:52,666 --> 00:30:56,433
BECAUSE THE FIRE SMOKE
HAD COME IN OVERNIGHT.

782

00:30:56,433 --> 00:30:58,733
AND IN FACT,
THERE WAS ANOTHER FIRE

783

00:30:58,733 --> 00:31:00,533
VERY CLOSE TO HOME THAT DAY,

784

00:31:00,533 --> 00:31:02,166
JUST ON MOUNT DIABLO.

785

00:31:02,166 --> 00:31:04,900
AND WE THINK THAT
THAT SMOKE WAS ALSO INFLUENCING

786

00:31:04,900 --> 00:31:06,566
THE AIR
IN THE SAN JOAQUIN VALLEY.

787

00:31:06,566 --> 00:31:08,933
AND SO THIS IS ACTUALLY
FIRE SMOKE

788

00:31:08,933 --> 00:31:11,700
THAT HAS BEEN DISPLACED AND HAS
MOVED INTO ANOTHER REGION

789

00:31:11,700 --> 00:31:13,566

WHERE IT'S AFFECTING
AIR QUALITY.

790

00:31:13,566 --> 00:31:16,833
HERE IT IS CLOSER TO THE FIRE
WHEN WE SAMPLED IT.

791

00:31:16,833 --> 00:31:18,700
WHAT YOU CAN'T SEE
ON THESE PLOTS

792

00:31:18,700 --> 00:31:20,466
BUT I'LL SHOW YOU LATER
IN A TABLE

793

00:31:20,466 --> 00:31:23,166
IS THAT THE RATIO OF METHANE
TO CO2

794

00:31:23,166 --> 00:31:26,066
IN THE PLUME THIS DAY
WAS MUCH DIFFERENT.

795

00:31:26,066 --> 00:31:29,266
IT'S A MUCH HIGHER RATIO
OF METHANE TO CO2

796

00:31:29,266 --> 00:31:32,233
LATER ON WHEN THE FIRE IS OLDER.

797

00:31:32,233 --> 00:31:34,866
WELL, YOU ASK, HOW ABOUT
A DIFFERENT FIRE?

798

00:31:34,866 --> 00:31:39,033
WELL, THE UNIVERSE
HAS BEEN VERY KIND TO US

799

00:31:39,033 --> 00:31:41,200
THE EL PORTAL FIRE WAS--

800

00:31:41,200 --> 00:31:43,766

WE SAMPLED IT LAST WEEK,
THE END OF JULY.

801

00:31:43,766 --> 00:31:45,766

I THINK THAT WAS LAST WEEK.

802

00:31:45,766 --> 00:31:48,933

AND IF YOU CAN RECOGNIZE
EL CAPITAN IN THIS PICTURE,

803

00:31:48,933 --> 00:31:50,333

YOU'RE DOING A GREAT JOB.

804

00:31:50,333 --> 00:31:52,266

BECAUSE IT MEANS YOU KNOW
WHAT EL CAPITAN LOOKS LIKE,

805

00:31:52,266 --> 00:31:54,933

BUT IT MEANS YOU CAN ALSO
SEE THROUGH THAT HORRIBLE HAZE.

806

00:31:56,800 --> 00:31:58,900

THESE, AGAIN,
WERE TAKEN BY THE BACKSEATER.

807

00:31:58,900 --> 00:32:01,066

AND YOU CAN SEE JUST WHAT
THE CONDITIONS LOOKED LIKE

808

00:32:01,066 --> 00:32:04,533

OUT THE WINDOW, JUST INCREDIBLE,
INCREDIBLE SMOKE.

809

00:32:06,333 --> 00:32:08,266

AND HERE'S WHAT
IT SHOULD HAVE LOOKED LIKE.

810

00:32:08,266 --> 00:32:11,166

SO HERE'S EL CAPITAN
ON A GOOD DAY.

811

00:32:11,166 --> 00:32:13,166

SO THESE HAVE BEEN
REALLY GREAT OPPORTUNITIES.

812

00:32:13,166 --> 00:32:15,500

AND AGAIN, THE TEAM
FROM SAN JOSÉ STATE WAS OUT,

813

00:32:15,500 --> 00:32:17,533

AND THIS IS THE KIND OF DATA
THAT THEY COLLECT.

814

00:32:17,533 --> 00:32:20,933

SO HERE YOU CAN SEE IN THE
BACKSCATTERING FROM THEIR LIDAR,

815

00:32:20,933 --> 00:32:24,233

THIS IS THE PLUME LOFTING

816

00:32:24,233 --> 00:32:26,933

AND STAYING QUITE HIGH,
ACTUALLY.

817

00:32:26,933 --> 00:32:29,166

THERE'S A LITTLE BIT OF HAZE
DOWN AT THE LOWER ALTITUDE.

818

00:32:29,166 --> 00:32:32,033

SO THIS IS
A MOUNTAIN CONTOUR HERE.

819

00:32:32,033 --> 00:32:34,600

BUT MOST OF THE SMOKE
IS STAYING UP HIGH.

820

00:32:34,600 --> 00:32:37,233

SO LET'S SEE WHAT WE SAW.

821

00:32:37,233 --> 00:32:38,966

WE, AGAIN, FLEW FROM AMES.

822

00:32:38,966 --> 00:32:40,833

I GUESS WE--

823

00:32:40,833 --> 00:32:42,966

EVAN, DID WE DO THE VERTICAL
PROFILE FIRST OR LAST?

824

00:32:42,966 --> 00:32:45,700

FIRST, OKAY.

I'VE GOT THE PICTURE BACKWARDS.

825

00:32:45,700 --> 00:32:47,966

WE FLEW FROM AMES,
AND WE SAW ACTUALLY HIGH OZONE

826

00:32:47,966 --> 00:32:49,333

IN THE VERTICAL PROFILE.

827

00:32:49,333 --> 00:32:51,733

THAT HAPPENS SOMETIMES.
YOU'VE SEEN THAT EARLIER.

828

00:32:51,733 --> 00:32:53,733

AND THEN WE DID A LOOP
AROUND THE FIRE.

829

00:32:53,733 --> 00:32:55,566

BUT I WANT TO BRING YOU IN
A LITTLE BIT CLOSER.

830

00:32:55,566 --> 00:32:58,233

OH, DON'T LET ME FORGET
TO TELL YOU THAT OZONE

831

00:32:58,233 --> 00:33:00,133
IS SOMETIMES FORMED
IN FOREST FIRE PLUMES,

832
00:33:00,133 --> 00:33:02,133
JUST LIKE ANY OTHER
POLLUTED ENVIRONMENT.

833
00:33:02,133 --> 00:33:04,100
IT FORMS IN CITIES
PHOTOCHEMICALLY

834
00:33:04,100 --> 00:33:06,800
FROM EMITTED HYDROCARBONS
AND NITROGEN OXIDES.

835
00:33:08,400 --> 00:33:10,900
IT IS BELIEVED TO BE FORMED
IN MANY SMOKE PLUMES.

836
00:33:10,900 --> 00:33:12,933
IT HAS BEEN OBSERVED TO BE
FORMED IN MANY SMOKE PLUMES.

837
00:33:12,933 --> 00:33:14,833
BUT THERE ARE ALSO PLUMES
WHERE IT'S BEEN OBSERVED

838
00:33:14,833 --> 00:33:16,666
TO NOT BE FORMED.

839
00:33:16,666 --> 00:33:18,700
AND SOMETIMES THE CHEMISTRY
EVEN RUNS BACKWARDS

840
00:33:18,700 --> 00:33:20,966
AND THE OZONE IS DEPLETED
IN SMOKE PLUMES,

841
00:33:20,966 --> 00:33:23,100

AND THAT'S THE CURRENT STATE
OF UNDERSTANDING,

842

00:33:23,100 --> 00:33:25,166
SOMETIMES YES AND SOMETIMES NO.
SO THIS ONE WAS NO.

843

00:33:25,166 --> 00:33:27,033
SO WE'RE VERY EXCITED,
ACTUALLY,

844

00:33:27,033 --> 00:33:29,400
BECAUSE THERE ISN'T AS MUCH
OBSERVATION OF LESS OZONE

845

00:33:29,400 --> 00:33:31,033
IN A FOREST FIRE PLUME.

846

00:33:31,033 --> 00:33:33,233
SO WE'RE GONNA KEEP AN EYE
ON OZONE AS WE GO THROUGH

847

00:33:33,233 --> 00:33:35,300
ALL OF THESE FOREST FIRES,
AND SEE WHAT WE CAN FIND OUT.

848

00:33:35,300 --> 00:33:37,066
IT'S SORT OF A SEPARATE PROBLEM

849

00:33:37,066 --> 00:33:39,266
BECAUSE IT HAS TO DO WITH
THE AIR QUALITY DOWNSTREAM.

850

00:33:39,266 --> 00:33:41,133
IN ADDITION TO THE PARTICLES
THAT ARE EMITTED,

851

00:33:41,133 --> 00:33:43,300
OZONE CAN BE FORMED
IN A SMOKE PLUME.

852

00:33:43,300 --> 00:33:46,133

SO THAT'S AN INTERESTING PIECE,
BUT LET ME SHOW YOU HERE,

853

00:33:46,133 --> 00:33:48,566

A LITTLE ZOOM IN
CLOSE TO THE PLUME.

854

00:33:48,566 --> 00:33:50,766

AGAIN, THESE ARE THE HOT SPOTS
FROM THE MODIS SATELLITE.

855

00:33:50,766 --> 00:33:52,966

AND I WANT TO MAKE SURE
THAT YOU NOTICE

856

00:33:52,966 --> 00:33:55,566

THIS LITTLE CUT ACROSS

857

00:33:55,566 --> 00:33:57,866

HERE IN THE FLIGHT TRACK.

858

00:33:57,866 --> 00:33:59,833

SO THEY DIPPED BACK IN.

859

00:33:59,833 --> 00:34:01,400

THEY CLOSED UP THE CIRCLE
A LITTLE BIT

860

00:34:01,400 --> 00:34:03,433

TO GET RIGHT INTO THE SMOKE.

861

00:34:03,433 --> 00:34:05,633

AND HERE IT IS.

862

00:34:05,633 --> 00:34:07,600

SO HERE'S THE VERTICAL PROFILE

863

00:34:07,600 --> 00:34:09,900
IN THE SAN JOAQUIN VALLEY
BOUNDARY LAYER

864

00:34:09,900 --> 00:34:11,566
WITH, YOU KNOW,
PRETTY BAD AIR QUALITY.

865

00:34:11,566 --> 00:34:14,066
BUT AGAIN, A LITTLE
DRAWDOWN OF THE CO₂,

866

00:34:14,066 --> 00:34:16,266
SO THE BIOSPHERE IS ACTIVE,
AND IT'S TAKING THE CO₂

867

00:34:16,266 --> 00:34:18,433
OUT OF THE AIR
IN THE SAN JOAQUIN VALLEY.

868

00:34:18,433 --> 00:34:21,166
THIS IS THAT LITTLE CUT-ACROSS
SPOT THAT I SHOWED YOU,

869

00:34:21,166 --> 00:34:22,566
THAT RED DOT OF DATA,

870

00:34:22,566 --> 00:34:25,800
AND THE METHANE
IS THIS SPIKE RIGHT HERE

871

00:34:25,800 --> 00:34:28,100
WHERE THEY NIPPED
RIGHT INTO THE PLUME.

872

00:34:28,100 --> 00:34:30,033
SO WE'VE GOT A TON OF GREAT DATA
FROM THAT FLIGHT

873

00:34:30,033 --> 00:34:31,566
AND THE NEXT ONE.

874
00:34:31,566 --> 00:34:34,033
AND WE'RE REALLY LOOKING FORWARD
TO ANALYZING IT.

875
00:34:36,300 --> 00:34:39,066
SO UP IN SHASTA COUNTY,
WHICH IS FAR NORTH,

876
00:34:39,066 --> 00:34:41,233
SO HERE'S WHERE WE TOOK OFF.
WE WENT TO THE NORTH.

877
00:34:41,233 --> 00:34:42,733
THIS PICTURE WILL TAKE A MINUTE
FOR YOUR EYES TO ADJUST,

878
00:34:42,733 --> 00:34:45,133
SO LET ME GIVE YOU A MINUTE
TO SEE IT.

879
00:34:45,133 --> 00:34:47,300
THIS IS A CLOUD FRONT HERE.

880
00:34:47,300 --> 00:34:50,200
SO THE REALLY BRIGHT STUFF
THAT YOU'RE SEEING IS CLOUDS.

881
00:34:50,200 --> 00:34:54,366
BUT THERE IS A GRAY SMEAR
OVER HERE,

882
00:34:54,366 --> 00:34:57,066
WHICH IS THE SMOKE.

883
00:34:57,066 --> 00:34:59,766
IF YOU LOOK OVER ON THE
CHEAT SHEET ON THE LEFT HERE,

884

00:34:59,766 --> 00:35:01,633

I'LL SHOW YOU THE HOT SPOTS

885

00:35:01,633 --> 00:35:03,600

TO GIVE YOU A CLUE

WHERE TO TRY TO SEE THE SMOKE.

886

00:35:03,600 --> 00:35:05,600

THERE'S ACTUALLY SOME HOT SPOTS

UNDER THE CLOUDS,

887

00:35:05,600 --> 00:35:07,366

AND THERE'S SOME UP HERE

TO THE NORTH.

888

00:35:07,366 --> 00:35:09,866

THE WINDS WERE COMING FROM

THE NORTH, NORTHWEST.

889

00:35:09,866 --> 00:35:13,000

AND THIS IS A PLOT OF--

WHAT DID I DO?

890

00:35:13,000 --> 00:35:15,900

I THINK I DID METHANE.

MAYBE IT'S CO2.

891

00:35:15,900 --> 00:35:17,866

I ACTUALLY CAN'T SEE THE PRINT.

IT'S MUCH TOO SMALL.

892

00:35:17,866 --> 00:35:19,333

IT'S CO2.

893

00:35:19,333 --> 00:35:20,966

THIS IS A PLOT OF CO2

ON THE FLIGHT TRACK.

894

00:35:20,966 --> 00:35:23,500
SO THERE WERE A COUPLE PLACES
WHERE WE GOT ENHANCED CO2.

895
00:35:23,500 --> 00:35:25,833
AND NOW WE'LL GO BACK
AND DO THE WIND ANALYSIS,

896
00:35:25,833 --> 00:35:28,366
AND WE'LL SEE HOW ROBUST
THOSE CORRELATIONS ARE

897
00:35:28,366 --> 00:35:31,800
OF THE CO2 TO THE HOT SPOTS
TO THE WIND INFORMATION

898
00:35:31,800 --> 00:35:33,800
AND TO THE ALTITUDE

899
00:35:33,800 --> 00:35:36,233
WHERE THERE MAY BE FOLDS

900
00:35:36,233 --> 00:35:38,433
OR LAYERS OF THE SMOKE.

901
00:35:38,433 --> 00:35:40,566
SO WE'RE REALLY LOOKING FORWARD
TO ANALYZING THAT.

902
00:35:40,566 --> 00:35:42,066
THAT WAS YESTERDAY,

903
00:35:42,066 --> 00:35:43,866
SO I REALLY NEED TO GIVE
A SHOUT-OUT TO MY TEAM,

904
00:35:43,866 --> 00:35:46,033
EMMA AND TOMOAKI AND WARREN,
ALL OF WHOM ARE HERE TODAY

905

00:35:46,033 --> 00:35:47,833

LOOKING WIDE AWAKE
AND PRESENTABLE,

906

00:35:47,833 --> 00:35:49,900

BUT WHO WERE ANALYZING--
COLLECTING AND ANALYZING

907

00:35:49,900 --> 00:35:51,933

THIS DATA YESTERDAY.

908

00:35:51,933 --> 00:35:54,733

SO WE'RE A TEAM PROJECT,
AND SOMETIMES THAT MEANS

909

00:35:54,733 --> 00:35:57,233

I GET TO TAKE THE SHOWER
AND GET A FULL NIGHT'S SLEEP

910

00:35:57,233 --> 00:35:59,333

AND THE TEAM GETS TO GET
COMFORTABLE CHAIRS

911

00:35:59,333 --> 00:36:01,533

AND GETS TO SIT BACK THERE

912

00:36:01,533 --> 00:36:03,666

WHERE NO ONE CAN THROW TOMATOES
AT THEM.

913

00:36:03,666 --> 00:36:05,966

HERE'S THE DATA IN THAT SAME
ANALYSIS FROM YESTERDAY.

914

00:36:05,966 --> 00:36:07,833

AND TO BE HONEST,

915

00:36:07,833 --> 00:36:09,966

I HAVEN'T LOOKED AT IT

VERY CAREFULLY YET,

916

00:36:09,966 --> 00:36:11,900

BUT YOU CAN SEE THE SAME SORTS
OF FEATURES, RIGHT?

917

00:36:11,900 --> 00:36:13,933

YOU CAN SEE THE DRAWDOWN.

918

00:36:13,933 --> 00:36:16,366

OH, I HAVEN'T LOOKED AT THIS
VERY CAREFULLY.

919

00:36:16,366 --> 00:36:18,266

I'M INTERESTED TO SEE
WHAT THIS TURNS OUT TO BE.

920

00:36:18,266 --> 00:36:20,433

THERE'S A BIG ENHANCEMENT OF CO2
IN THE CENTRAL VALLEY.

921

00:36:20,433 --> 00:36:22,833

AND YOU CAN SEE THE SMOKE PLUME

922

00:36:22,833 --> 00:36:25,566

PROBABLY RIGHT HERE AND HERE.

923

00:36:25,566 --> 00:36:27,466

SO ASK ME IN A COUPLE WEEKS,

924

00:36:27,466 --> 00:36:30,200

AND I'LL TELL YOU WHAT HAPPENED
ON YESTERDAY'S FLIGHT.

925

00:36:30,200 --> 00:36:33,533

BUT I CAN SHOW YOU SOME NUMBERS,

926

00:36:33,533 --> 00:36:36,600

AND I'M NOT GONNA PROMISE

THAT THEY'RE PERFECT YET.

927

00:36:36,600 --> 00:36:40,500

BUT LET ME COMPARE FOR YOU THE
FOUR FLIGHTS I'VE SHOWN YOU NOW.

928

00:36:40,500 --> 00:36:41,966

WE'VE GOT RIM FIRE EARLY ON.

929

00:36:41,966 --> 00:36:44,100

WE'VE GOT RIM FIRE LATER
WHEN IT WAS SMOLDERING.

930

00:36:44,100 --> 00:36:46,066

WE'VE GOT EL PORTAL,

931

00:36:46,066 --> 00:36:48,066

AND WE'VE GOT YESTERDAY'S
SHASTA COUNTY FIRES.

932

00:36:48,066 --> 00:36:50,766

SO THIS NUMBER
DOWN AT THE BOTTOM

933

00:36:50,766 --> 00:36:52,266

IS THAT RATIO
I'VE BEEN TELLING YOU ABOUT--

934

00:36:52,266 --> 00:36:54,700

HOW MUCH METHANE FOR EVERY CO2.

935

00:36:54,700 --> 00:36:57,000

METHANE'S 120 TIMES WORSE
AS A GREENHOUSE GAS.

936

00:36:57,000 --> 00:37:00,133

AND IT STILL HAS A LITTLE MORE
POLLUTING CHEMISTRY TO DO, TOO.

937

00:37:00,133 --> 00:37:02,700
IT'S NOT REALLY DONE
UNTIL IT GETS TO CO₂.

938
00:37:02,700 --> 00:37:04,100
SO IT'S INTERESTING TO
UNDERSTAND THE BALANCE

939
00:37:04,100 --> 00:37:05,933
OF HOW CARBON
COMES OUT OF THE FIRE.

940
00:37:05,933 --> 00:37:07,566
SO LOOK ACROSS THE BOTTOM.

941
00:37:07,566 --> 00:37:09,000
THESE NUMBERS
ARE SOMETHING LIKE 8,

942
00:37:09,000 --> 00:37:10,933
EXCEPT FOR THE RED ONES
THAT ARE SOMETHING LIKE 16

943
00:37:10,933 --> 00:37:13,333
AND THE BLUE ONE
THAT'S SOMETHING LIKE 4.

944
00:37:13,333 --> 00:37:16,133
SO YOU'RE SEEING A FACTOR
OF ABOUT 4 IN THAT RATIO

945
00:37:16,133 --> 00:37:18,566
OF HOW MUCH OF THE CARBON
COMES OUT AS METHANE

946
00:37:18,566 --> 00:37:20,566
FROM ONE FIRE TO THE NEXT.

947
00:37:20,566 --> 00:37:22,400
SO THAT'S SOMETHING WE'RE REALLY

INTERESTED IN LOOKING INTO.

948

00:37:22,400 --> 00:37:24,233

HOPE--HOPEFULLY,
THE SHASTA FIRES

949

00:37:24,233 --> 00:37:26,433

WILL KEEP BURNING FOR A WHILE
AND WE CAN GO SEE THEM AGAIN

950

00:37:26,433 --> 00:37:28,800

WHEN THEY'RE OLD AND SMOLDERY.

951

00:37:31,433 --> 00:37:33,400

AS WE CONTINUE
TO DO THESE MISSIONS,

952

00:37:33,400 --> 00:37:35,400

YOU CAN FOLLOW US
IF YOU'D LIKE.

953

00:37:35,400 --> 00:37:37,333

THERE IS A REALLY GREAT TOOL

954

00:37:37,333 --> 00:37:39,966

IN THE NASA AIRBORNE SCIENCE
PROJECT--

955

00:37:39,966 --> 00:37:42,166

NASA AIRBORNE SCIENCE OFFICE?

956

00:37:42,166 --> 00:37:44,266

NASA AIRBORNE SCIENCE
HAS A GREAT TOOL

957

00:37:44,266 --> 00:37:46,700

CALLED THE MISSION TOOLS SUITE.

958

00:37:46,700 --> 00:37:49,466

AND IF YOU CAN REMEMBER THAT,
YOU CAN FIND THEIR WEB SITE.

959

00:37:49,466 --> 00:37:52,033

AND YOU CAN FOLLOW US
BY OUR TAIL NUMBER.

960

00:37:52,033 --> 00:37:54,066

WE'RE ALSO LISTED
AS THE ALPHA JET.

961

00:37:54,066 --> 00:37:55,966

WE'RE THE ONLY ALPHA JET
IN THE LIST.

962

00:37:55,966 --> 00:37:57,933

AND YOU CAN WATCH US
IN REAL TIME.

963

00:37:57,933 --> 00:37:59,533

THERE'S A--IT'S, LIKE,
EVERY TEN SECONDS

964

00:37:59,533 --> 00:38:02,133

THEY UPDATE THE LOCATION
OF THE AIRCRAFT.

965

00:38:02,133 --> 00:38:04,366

YOU CAN ALSO GO BACK AND LOOK
AT OUR PREVIOUS TRACKS,

966

00:38:04,366 --> 00:38:06,500

ALTHOUGH WE ONLY GOT THE TRACKER
INSTALLED A FEW FLIGHTS AGO.

967

00:38:06,500 --> 00:38:08,333

SO THERE'S ONLY A FEW OF THEM
TO LOOK AT.

968

00:38:08,333 --> 00:38:10,133

BUT THIS ONE IS IN THERE.

969

00:38:10,133 --> 00:38:12,066
YOU CAN ALSO FOLLOW ME
ON TWITTER

970

00:38:12,066 --> 00:38:14,100
IF YOU'RE REALLY, REALLY BORED.

971

00:38:14,100 --> 00:38:16,200
I TWEET, LIKE, RIGHT BEFORE
EVERY FLIGHT AND RIGHT AFTER.

972

00:38:16,200 --> 00:38:18,333
I PROMISE, YOU WON'T GET
VERY MANY TWEETS FROM ME.

973

00:38:18,333 --> 00:38:20,300
AND YOU CAN CHECK US OUT
ON YOUTUBE

974

00:38:20,300 --> 00:38:21,966
IF YOU'RE REALLY FEELING
ADVENTURESOME.

975

00:38:21,966 --> 00:38:23,466
THERE'S A COUPLE OF PLACES
WHERE YOU CAN FIND US,

976

00:38:23,466 --> 00:38:26,133
AND I'M CERTAINLY NOT GONNA READ
THOSE LINKS OUT TO YOU.

977

00:38:26,133 --> 00:38:29,400
BUT WE WERE REALLY FORTUNATE
TO PARTICIPATE IN A PROGRAM

978

00:38:29,400 --> 00:38:31,500
CALLED THE "YEARS OF LIVING
DANGEROUSLY."

979

00:38:31,500 --> 00:38:33,133

AS DR. BICAY MENTIONED,

980

00:38:33,133 --> 00:38:35,133

WE DO A LOT OF

SATELLITE VALIDATION WORK,

981

00:38:35,133 --> 00:38:36,833

NONE OF WHICH I SHOWED YOU

TODAY,

982

00:38:36,833 --> 00:38:38,733

'CAUSE IT'S NOT IN CALIFORNIA.

IT'S ACTUALLY IN NEVADA.

983

00:38:38,733 --> 00:38:40,800

THERE'S A VERY SHINY,

FLAT PLACE IN NEVADA

984

00:38:40,800 --> 00:38:42,266

WHERE A LOT OF SATELLITES

WILL STARE

985

00:38:42,266 --> 00:38:47,200

TO CALIBRATE THEIR MEASUREMENTS

OF BRIGHTNESS.

986

00:38:47,200 --> 00:38:49,500

SORT OF THE FUNDAMENTAL

MEASUREMENT OF A SATELLITE

987

00:38:49,500 --> 00:38:52,000

IS ITS RADIOMETRIC CALIBRATION.

988

00:38:52,000 --> 00:38:54,966

SO THAT PLACE IS

FORTUNATELY CLOSE ENOUGH

989

00:38:54,966 --> 00:38:56,600
THAT WE CAN GET THERE AND BACK
ON ONE TANK OF GAS.

990
00:38:56,600 --> 00:38:58,633
SO WE GO THERE
ABOUT EVERY MONTH

991
00:38:58,633 --> 00:39:00,833
TO UNDER-FLY A SATELLITE
CALLED GOSAT,

992
00:39:00,833 --> 00:39:02,966
WHICH IS A JAPANESE SATELLITE
WHICH MEASURES CO2.

993
00:39:02,966 --> 00:39:05,433
AND, HUZZAH,

994
00:39:05,433 --> 00:39:08,100
OCO-2, THE NASA
ORBITING CARBON OBSERVATORY,

995
00:39:08,100 --> 00:39:12,100
HAS JUST, A MONTH AGO,
LAUNCHED SUCCESSFULLY

996
00:39:12,100 --> 00:39:13,400
AND HAS FINALLY REACHED
ITS ORBIT

997
00:39:13,400 --> 00:39:15,600
IN A SATELLITE CLUSTER
CALLED THE A-TRAIN.

998
00:39:15,600 --> 00:39:17,933
SO THOSE, AS SOON AS
THEY GET COOLED DOWN,

999
00:39:17,933 --> 00:39:19,466

THAT SATELLITE WILL ALSO BE
MEASURING

1000
00:39:19,466 --> 00:39:21,900
ITS RADIOMETRIC CALIBRATION
AT RAILROAD VALLEY

1001
00:39:21,900 --> 00:39:24,400
AND IT WILL ALSO TAKE REGULAR
MEASUREMENTS AT RAILROAD VALLEY.

1002
00:39:24,400 --> 00:39:26,666
SO WE'LL BE FLYING THERE
EVEN MORE OFTEN

1003
00:39:26,666 --> 00:39:28,466
TO MEASURE THE CARBON DIOXIDE
IN THE COLUMN

1004
00:39:28,466 --> 00:39:31,300
UNDERNEATH THE SATELLITE
AS IT FLIES OVERHEAD.

1005
00:39:31,300 --> 00:39:33,766
ONE OF THE DAYS
WHEN WE WERE DOING THAT,

1006
00:39:33,766 --> 00:39:35,533
LAST NOVEMBER,

1007
00:39:35,533 --> 00:39:38,300
THIS DOCUMENTARY CREW FOR THE
"YEARS OF LIVING DANGEROUSLY"

1008
00:39:38,300 --> 00:39:40,033
CAME TO AMES

1009
00:39:40,033 --> 00:39:42,933
AND MY NEW BEST FRIEND
FLEW THE BACKSEAT

1010

00:39:42,933 --> 00:39:44,900

BECAUSE, I DIDN'T KNOW THIS,

1011

00:39:44,900 --> 00:39:47,000

HARRISON FORD

IS A CERTIFIED PILOT.

1012

00:39:47,000 --> 00:39:50,133

SO HE WAS EAGER TO LEARN

ABOUT THE PROJECT

1013

00:39:50,133 --> 00:39:53,000

AND, HONESTLY,

THE RAILROAD VALLEY FLIGHT

1014

00:39:53,000 --> 00:39:55,366

IS ONE THAT--THAT OUR PILOTS

KNOW REALLY WELL.

1015

00:39:55,366 --> 00:39:57,133

IT'S A PRETTY SIMPLE FLIGHT.

1016

00:39:57,133 --> 00:39:59,133

THEY'VE DONE IT

PROBABLY 30 TIMES BY NOW.

1017

00:39:59,133 --> 00:40:01,933

AND SO THEY ACTUALLY LET HIM FLY

THE BACKSEAT,

1018

00:40:01,933 --> 00:40:03,966

AND HE COLLECTED THE DATA

FOR US.

1019

00:40:03,966 --> 00:40:06,500

AND SO YOU CAN SEE

THAT DOCUMENTARY,

1020

00:40:06,500 --> 00:40:09,000
BUT MORE IMPORTANTLY, YOU CAN
SEE THE NIFTY LITTLE PIECE

1021
00:40:09,000 --> 00:40:10,466
THAT AMES PRODUCED
ABOUT THE VISIT

1022
00:40:10,466 --> 00:40:12,700
OF HARRISON FORD TO AMES.

1023
00:40:12,700 --> 00:40:15,000
WE GET WAY MORE FILM TIME
ON THAT ONE.

1024
00:40:15,000 --> 00:40:17,566
WE GET, LIKE, FIVE SECONDS
IN THE SHOWTIME DOCUMENTARY,

1025
00:40:17,566 --> 00:40:19,500
BUT WE'VE GOT, LIKE,
THREE MINUTES IN THE AMES VIDEO,

1026
00:40:19,500 --> 00:40:21,133
SO GO TO THE AMES VIDEO.

1027
00:40:21,133 --> 00:40:23,166
THERE'S LOTS MORE ABOUT
THE AJAX PROJECT IN THAT.

1028
00:40:23,166 --> 00:40:25,100
SO THERE'S LOTS OF PLACES
TO FIND US.

1029
00:40:25,100 --> 00:40:27,066
I'M GONNA BE AROUND HERE, TOO.

1030
00:40:27,066 --> 00:40:29,200
IF SOMEONE WILL BRING ME
A COOKIE, I'LL STAY FOR HOURS.

1031

00:40:29,200 --> 00:40:31,700

BUT I WOULD LIKE TO THANK
THE TEAM--

1032

00:40:31,700 --> 00:40:33,066

AND I KNOW THERE ARE NAMES
MISSING,

1033

00:40:33,066 --> 00:40:35,333

AND I APOLOGIZE FOR THAT,
BUT LIKE I SAID,

1034

00:40:35,333 --> 00:40:37,866

THIS IS A TEAM EFFORT,
AND THERE'S NO WAY

1035

00:40:37,866 --> 00:40:39,766

NO MATTER HOW MUCH CAFFEINE
I COULD DRINK,

1036

00:40:39,766 --> 00:40:41,533

THAT I COULD DO THIS MYSELF.

1037

00:40:41,533 --> 00:40:43,066

AND EVERY PROBLEM
WE COME UP AGAINST,

1038

00:40:43,066 --> 00:40:44,933

ONE OF THESE PEOPLE HAS SOLVED.

1039

00:40:44,933 --> 00:40:47,966

AND IT'S AMAZING HOW MANY HOURS
PEOPLE ARE WILLING TO PUT IN

1040

00:40:47,966 --> 00:40:50,900

WHEN YOU SAY, "BUT THERE'S
GONNA BE GOOD DATA."

1041

00:40:50,900 --> 00:40:54,200
IT'S ALMOST AS GOOD AS,
"THERE'S GONNA BE FREE COOKIES."

1042
00:40:54,200 --> 00:40:55,600
SO I REALLY NEED TO THANK
MY TEAM--

1043
00:40:55,600 --> 00:40:57,200
EMMA, TOMOAKI, AND WARREN,
IN PARTICULAR.

1044
00:40:57,200 --> 00:40:58,666
CHRIS IS OUR METEOROLOGIST,

1045
00:40:58,666 --> 00:41:01,566
AND QUINCY AND EMMETT
SOLVE ALL PROBLEMS

1046
00:41:01,566 --> 00:41:05,166
RELATED TO MECHANICAL PARTS
AND GRAVITY.

1047
00:41:05,166 --> 00:41:08,000
AND THEN I DID WANT TO TELL YOU
JUST A LITTLE BIT ABOUT ME

1048
00:41:08,000 --> 00:41:10,033
IF JACOB HAD A MINUTE LEFT.

1049
00:41:10,033 --> 00:41:12,133
I KNOW YOU MIGHT THINK,
HOW ON EARTH

1050
00:41:12,133 --> 00:41:14,133
WOULD I GET INVOLVED
WITH A PROJECT LIKE THIS?

1051
00:41:14,133 --> 00:41:16,533
AND THE ANSWER IS,

HELL IF I KNOW.

1052

00:41:16,533 --> 00:41:18,066

I STARTED IN NEW YORK.

1053

00:41:18,066 --> 00:41:20,133

I WENT TO A SMALL
LIBERAL ARTS COLLEGE.

1054

00:41:20,133 --> 00:41:22,800

MY MOTHER BEMOANED THE FACT
THAT I THEN WENT WEST,

1055

00:41:22,800 --> 00:41:24,700

AND I WOUND UP IN COLORADO
FOR GRADUATE SCHOOL.

1056

00:41:24,700 --> 00:41:26,833

AND SHE SAID, "COME BACK EAST
WHEN YOU'RE DONE."

1057

00:41:26,833 --> 00:41:28,833

AND I SAID, "SURE, MOM.
I'M GOING TO CALIFORNIA."

1058

00:41:28,833 --> 00:41:31,366

SO I'VE BEEN MOVING WEST
EVER SINCE.

1059

00:41:31,366 --> 00:41:33,966

I TOOK A DETOUR TO DO AN
INTERNSHIP AT NASA GODDARD.

1060

00:41:33,966 --> 00:41:35,433

ACTUALLY, THAT WAS WHERE
I FIRST GOT INTERESTED

1061

00:41:35,433 --> 00:41:37,033

IN ATMOSPHERIC CHEMISTRY.

1062

00:41:37,033 --> 00:41:39,266

THAT WAS MY FIRST SORT OF
HANDS-ON OPPORTUNITY

1063

00:41:39,266 --> 00:41:41,733

TO PLAY WITH CHEMISTRY
IN THE EARTH'S ATMOSPHERE.

1064

00:41:41,733 --> 00:41:43,633

IT WAS JUST IN A MODEL.
I PROMISE.

1065

00:41:43,633 --> 00:41:45,466

I DIDN'T DO ANYTHING EVIL.

1066

00:41:45,466 --> 00:41:47,533

BUT IT WAS ALSO MY FIRST CHANCE
TO TRY ATMOSPHERIC MODELING.

1067

00:41:47,533 --> 00:41:49,900

YOU SEE, I WENT BACK TO THE LAB.

1068

00:41:49,900 --> 00:41:51,633

SO MY TRAINING IS ACTUALLY
IN LABORATORY,

1069

00:41:51,633 --> 00:41:53,533

SORT OF, HANDS-ON MEASUREMENTS.

1070

00:41:53,533 --> 00:41:55,266

BUT I'D NEVER HAD
THE OPPORTUNITY

1071

00:41:55,266 --> 00:41:58,100

TO DO ANYTHING
THAT WOULD BE LAUNCHED

1072

00:41:58,100 --> 00:41:59,433

UNTIL I WAS HERE AT AMES.

1073

00:41:59,433 --> 00:42:01,200

AND REALLY,
THE--THE DIRECTION FROM OUR--

1074

00:42:01,200 --> 00:42:04,333

AND THE SUPPORT
FROM OUR DIVISION MANAGEMENT

1075

00:42:04,333 --> 00:42:06,433

AND OUR BRANCH MANAGEMENT
HAS REALLY BEEN AMAZING.

1076

00:42:06,433 --> 00:42:08,633

AND I HAVE NO AIRCRAFT PEDIGREE.

1077

00:42:08,633 --> 00:42:12,400

IN 2008, WHEN THEY SAID,
"HERE, LAURA, MAKE THIS WORK,"

1078

00:42:12,400 --> 00:42:15,533

AND LOOK WHAT WE CAN ACCOMPLISH
IN SIX YEARS.

1079

00:42:15,533 --> 00:42:17,600

SO IT'S REALLY BEEN GREAT
TO BE HERE AT AMES,

1080

00:42:17,600 --> 00:42:19,566

WHERE I HAVE SO MANY DIFFERENT
COLLEAGUES TO WORK WITH

1081

00:42:19,566 --> 00:42:21,100

AND THE OPPORTUNITY
TO TRY NEW THINGS,

1082

00:42:21,100 --> 00:42:23,400

LIKE AIRCRAFT MEASUREMENTS,
THAT I'D NEVER DONE BEFORE.

1083
00:42:23,400 --> 00:42:25,133
AND IF YOU WANT TO TALK ABOUT
CLOUDS ON MARS,

1084
00:42:25,133 --> 00:42:26,700
I'M LEARNING ABOUT THAT, TOO.

1085
00:42:26,700 --> 00:42:29,066
SO BRING ME A COOKIE AND WE CAN
TALK ABOUT CLOUDS ON MARS.

1086
00:42:29,066 --> 00:42:30,966
SO MY JOURNEY'S REALLY GONE
FROM UPSTATE NEW YORK

1087
00:42:30,966 --> 00:42:33,433
THROUGH MARYLAND
TO COLORADO

1088
00:42:33,433 --> 00:42:36,166
TO CALIFORNIA
AND NEXT STOP WILL BE MARS,

1089
00:42:36,166 --> 00:42:37,200
BUT DON'T TELL MY MOTHER.

1090
00:42:37,200 --> 00:42:40,433
[laughter]
THANKS.

1091
00:42:40,433 --> 00:42:42,500
[applause]

1092
00:42:42,500 --> 00:42:46,566
SHE'S PROBABLY GONNA WATCH
THE VIDEO.

1093
00:42:46,566 --> 00:42:48,766
- SO WE HAVE TIME

FOR A FEW QUESTIONS.

1094

00:42:48,766 --> 00:42:51,033

PLEASE RAISE YOUR HAND,
STAND UP,

1095

00:42:51,033 --> 00:42:54,300

WAIT FOR THE MICROPHONE.

1096

00:42:54,300 --> 00:42:56,466

- OR JUST BRING ME A COOKIE.

1097

00:42:56,466 --> 00:42:58,466

- YES, OR BRING COOKIES.

1098

00:43:04,133 --> 00:43:06,700

- HI.

VERY INTERESTING, THANK YOU.

1099

00:43:06,700 --> 00:43:09,333

THE--THE AJAX AIRCRAFT

1100

00:43:09,333 --> 00:43:11,100

IS--IS UNIQUE, YOU KNOW,

1101

00:43:11,100 --> 00:43:13,966

IN TERMS OF IT BEING STATIONED
HERE AND AVAILABLE HERE.

1102

00:43:13,966 --> 00:43:17,133

AND I WONDER IF YOU'VE LOOKED
AT INSTRUMENTATION

1103

00:43:17,133 --> 00:43:19,433

ON OTHER TYPES OF VEHICLES.

1104

00:43:19,433 --> 00:43:21,366

A FEW YEARS BACK,

1105
00:43:21,366 --> 00:43:23,100
SOME--SOME FOLKS HERE AT AMES

1106
00:43:23,100 --> 00:43:26,266
WERE PUTTING INSTRUMENTATION
ON THE "IKHANA" UAV.

1107
00:43:26,266 --> 00:43:28,733
AND SO I'M CURIOUS
IF YOU COULD COMMENT

1108
00:43:28,733 --> 00:43:30,833
ON SORT OF THE PORTABILITY
OF THE MEASUREMENTS

1109
00:43:30,833 --> 00:43:32,966
AND THAT KIND OF THING,

1110
00:43:32,966 --> 00:43:35,333
TO BROADEN THE PLACES
WE COULD GO

1111
00:43:35,333 --> 00:43:37,500
RATHER THAN RELYING
JUST ON THE AJAX AIRCRAFT.

1112
00:43:37,500 --> 00:43:39,533
- MM-HMM, SURE.

1113
00:43:39,533 --> 00:43:41,600
THE REAL ADVANTAGE--

1114
00:43:41,600 --> 00:43:43,633
THERE ARE TWO REAL ADVANTAGES
TO US

1115
00:43:43,633 --> 00:43:47,200
WHEN DESIGNING
TO THE ALPHA JET.

1116

00:43:47,200 --> 00:43:49,233

ONE IS THAT THE MOUNTING POINTS

1117

00:43:49,233 --> 00:43:51,400

ARE A STANDARD NATO
MOUNTING POINT.

1118

00:43:51,400 --> 00:43:53,233

SO THAT WING POD
CAN ACTUALLY

1119

00:43:53,233 --> 00:43:55,666

JUST BE CLIPPED ON
TO ANOTHER AIRCRAFT,

1120

00:43:55,666 --> 00:43:57,666

ANY OTHER AIRCRAFT THAT HAS
A NATO MOUNTING POINT,

1121

00:43:57,666 --> 00:44:00,866

WHICH IS RELATIVELY STANDARD
AS FAR AS THINGS GO.

1122

00:44:00,866 --> 00:44:02,000

THE DISADVANTAGE, THOUGH,

1123

00:44:02,000 --> 00:44:05,800

IS THAT THE ALPHA JET'S
A BOMBER,

1124

00:44:05,800 --> 00:44:08,366

AND SO WE HAVEN'T HAD
TO BE CAREFUL ABOUT WEIGHT.

1125

00:44:08,366 --> 00:44:10,400

IT CAN CARRY A TON OF WEIGHT.

1126

00:44:10,400 --> 00:44:13,200

SO WE'VE BEEN ABLE
TO GET AWAY WITH

1127

00:44:13,200 --> 00:44:15,233
SORT OF THE EASY SOLUTION
FOR PUMPS,

1128

00:44:15,233 --> 00:44:17,133
AND WE HAVE PLENTY OF POWER
AVAILABLE.

1129

00:44:17,133 --> 00:44:19,800
SO OUR PROBLEM
IS ACTUALLY VOLUME,

1130

00:44:19,800 --> 00:44:21,166
NOT MASS.

1131

00:44:21,166 --> 00:44:23,566
SO I'M NOT SURE ABOUT
THE "IKHANA."

1132

00:44:23,566 --> 00:44:25,633
I WOULD HATE TO BE ON TAPE AS--

1133

00:44:25,633 --> 00:44:27,866
COMMENTING ON
ITS SPECIFICATIONS,

1134

00:44:27,866 --> 00:44:30,766
BUT WE HAVEN'T HAD TO
PAY ATTENTION TO WEIGHT.

1135

00:44:30,766 --> 00:44:32,566
AND I KNOW ON A LOT OF OTHER
PLATFORMS, THEY DO,

1136

00:44:32,566 --> 00:44:34,833
ESPECIALLY A UAV.
YOUR PAYLOAD HAS TO BE SMALL

1137

00:44:34,833 --> 00:44:36,766

BUT IT ALSO HAS TO BE
VERY LIGHTWEIGHT.

1138

00:44:36,766 --> 00:44:38,966

SO WE'VE DESIGNED PRETTY
SPECIFICALLY FOR THE ALPHA JET.

1139

00:44:38,966 --> 00:44:40,633

THAT SIZE THAT WE HAVE,

1140

00:44:40,633 --> 00:44:42,533

THE SIZE AND SHAPE
ARE VERY SPECIFIC.

1141

00:44:42,533 --> 00:44:45,766

BUT THEY'RE SMALLER
THAN MOST OTHER AIRCRAFT

1142

00:44:45,766 --> 00:44:47,500

THAT CAN CARRY HEAVY LOADS.

1143

00:44:47,500 --> 00:44:49,800

SO WE COULD BE PRETTY PORTABLE
INTO AN AIRCRAFT

1144

00:44:49,800 --> 00:44:53,233

WHERE WEIGHT IS NOT A CONCERN.

1145

00:44:54,566 --> 00:44:56,000

- ALL RIGHT, THANK YOU.

1146

00:44:56,000 --> 00:44:58,400

LET'S JOIN ME
IN THANKING DR. BLAZE--

1147

00:44:58,400 --> 00:45:00,400

SORRY, LAURA.

1148

00:45:00,400 --> 00:45:01,900

THANK YOU VERY MUCH
FOR A GREAT TALK.

1149

00:45:01,900 --> 00:45:05,100

[applause]