



**Jud Ready, Ph.D.**

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1  
00:00:07,430 --> 00:00:04,710  
this is mission control houston again uh

2  
00:00:10,230 --> 00:00:07,440  
joining us by telephone today we have a

3  
00:00:12,629 --> 00:00:10,240  
special guest uh interview with uh

4  
00:00:15,270 --> 00:00:12,639  
debbie judd reedy who is from the

5  
00:00:17,830 --> 00:00:15,280  
georgia institute of technology and he's

6  
00:00:20,310 --> 00:00:17,840  
just gotten happy news that his

7  
00:00:24,070 --> 00:00:20,320  
experiment that is going to be looking

8  
00:00:26,150 --> 00:00:24,080  
at how to improve uh the manufacture of

9  
00:00:28,070 --> 00:00:26,160  
photovoltic cells on the

10  
00:00:29,349 --> 00:00:28,080  
international space station

11  
00:00:32,310 --> 00:00:29,359  
is actually going to fly to the space

12  
00:00:34,630 --> 00:00:32,320  
station welcome dr reedy thank you kelly

13  
00:00:36,709 --> 00:00:34,640

it's uh it is a very exciting it's a

14

00:00:37,990 --> 00:00:36,719

boyhood dream come true to fly in space

15

00:00:40,229 --> 00:00:38,000

even if i'm not actually doing it

16

00:00:42,229 --> 00:00:40,239

something that we handle is is going to

17

00:00:43,750 --> 00:00:42,239

do it so that's it's very exciting well

18

00:00:45,510 --> 00:00:43,760

welcome to mission control tell us a

19

00:00:48,310 --> 00:00:45,520

little bit more about your experiment

20

00:00:50,150 --> 00:00:48,320

well what our experiment does is use a

21

00:00:51,750 --> 00:00:50,160

light trapping morphology on the solar

22

00:00:53,990 --> 00:00:51,760

cell it's a three-dimensional solar cell

23

00:00:56,229 --> 00:00:54,000

so it captures light from multiple

24

00:00:59,349 --> 00:00:56,239

angles which is particularly relevant on

25

00:01:02,389 --> 00:00:59,359

the space station because it goes around

26  
00:01:04,469 --> 00:01:02,399  
so many times the earth so many times um

27  
00:01:07,429 --> 00:01:04,479  
you've got mechanical tracking arrays on

28  
00:01:10,710 --> 00:01:07,439  
it to keep the the solar flux uh

29  
00:01:12,149 --> 00:01:10,720  
powering the the the channels

30  
00:01:16,149 --> 00:01:12,159  
and we're looking at some pictures that

31  
00:01:18,710 --> 00:01:16,159  
you sent us these look like tiny cubes

32  
00:01:19,990 --> 00:01:18,720  
uh yes we've got um

33  
00:01:21,510 --> 00:01:20,000  
they're actually

34  
00:01:23,670 --> 00:01:21,520  
if you zoom right in the carbon

35  
00:01:24,870 --> 00:01:23,680  
nanotubes are very um

36  
00:01:26,310 --> 00:01:24,880  
vine like

37  
00:01:28,469 --> 00:01:26,320  
and so we try to coat those with our

38  
00:01:30,230 --> 00:01:28,479

photo absorber materials

39

00:01:31,830 --> 00:01:30,240

we've done it in the past using cadmium

40

00:01:34,390 --> 00:01:31,840

telluride as the

41

00:01:36,550 --> 00:01:34,400

the photon absorbing material

42

00:01:38,870 --> 00:01:36,560

this proposal is using a new chemistry

43

00:01:41,109 --> 00:01:38,880

new photochemistry known as czts copper

44

00:01:41,990 --> 00:01:41,119

zinc 10 sulfide

45

00:01:43,190 --> 00:01:42,000

okay

46

00:01:44,630 --> 00:01:43,200

and so uh

47

00:01:47,030 --> 00:01:44,640

you mentioned that they're three

48

00:01:48,230 --> 00:01:47,040

dimensional i'm guessing that the cells

49

00:01:49,990 --> 00:01:48,240

were using

50

00:01:51,510 --> 00:01:50,000

in most applications here on the ground

51  
00:01:53,990 --> 00:01:51,520  
and in space right now are two

52  
00:01:55,670 --> 00:01:54,000  
dimensional type cells that's correct

53  
00:01:57,030 --> 00:01:55,680  
they're planar there was before we

54  
00:01:59,749 --> 00:01:57,040  
developed this technology back in the

55  
00:02:01,510 --> 00:01:59,759  
early 2000s there was no way to texture

56  
00:02:03,190 --> 00:02:01,520  
what are known as thin film

57  
00:02:04,709 --> 00:02:03,200  
um

58  
00:02:07,190 --> 00:02:04,719  
photovoltaic cells you they could

59  
00:02:09,669 --> 00:02:07,200  
texture silicon cells by etching little

60  
00:02:11,510 --> 00:02:09,679  
pyramids into the

61  
00:02:12,949 --> 00:02:11,520  
silicon structure itself

62  
00:02:14,790 --> 00:02:12,959  
and that would provide a light trapping

63  
00:02:17,190 --> 00:02:14,800

basically what it does is it allows the

64

00:02:19,350 --> 00:02:17,200

photon of light to hit the solar cell

65

00:02:21,990 --> 00:02:19,360

and if it does not get absorbed it will

66

00:02:23,990 --> 00:02:22,000

reflect off and hit the solar cell again

67

00:02:25,830 --> 00:02:24,000

inside this pyramidal pit well we do the

68

00:02:27,030 --> 00:02:25,840

same thing but we create vertical

69

00:02:29,110 --> 00:02:27,040

structures

70

00:02:32,070 --> 00:02:29,120

that we then coat with with our photo

71

00:02:34,470 --> 00:02:32,080

absorbers such as cad tell sigs ccts all

72

00:02:36,390 --> 00:02:34,480

the various different thin film

73

00:02:38,869 --> 00:02:36,400

absorbers okay and you mentioned that

74

00:02:41,110 --> 00:02:38,879

this has potential uh applications in

75

00:02:43,430 --> 00:02:41,120

space because naturally you've got a

76

00:02:45,110 --> 00:02:43,440

more three-dimensional capability to

77

00:02:47,430 --> 00:02:45,120

collect the sunlight

78

00:02:49,350 --> 00:02:47,440

uh in space as the space station orbits

79

00:02:50,390 --> 00:02:49,360

the earth and the solar rays can track

80

00:02:52,630 --> 00:02:50,400

the sun

81

00:02:54,070 --> 00:02:52,640

what about on earth is this technology

82

00:02:56,710 --> 00:02:54,080

of potential use for us here on the

83

00:02:59,270 --> 00:02:56,720

ground certainly it'd be very useful on

84

00:03:01,830 --> 00:02:59,280

the ground the key benefit from the czts

85

00:03:04,070 --> 00:03:01,840

absorber is it's low low cost

86

00:03:06,550 --> 00:03:04,080

the 3d

87

00:03:08,390 --> 00:03:06,560

morphology allows us to capture light

88

00:03:10,470 --> 00:03:08,400

without having tracking arrays usually

89

00:03:13,350 --> 00:03:10,480

we don't have tracking arrays on a

90

00:03:14,869 --> 00:03:13,360

terrestrial emplacement of a solar cell

91

00:03:17,350 --> 00:03:14,879

usually you just sort of optimize that

92

00:03:19,509 --> 00:03:17,360

on the roof at a given angle that's

93

00:03:21,430 --> 00:03:19,519

as close as perfect as you can get which

94

00:03:23,110 --> 00:03:21,440

is not very close at all

95

00:03:24,390 --> 00:03:23,120

for your latitude and

96

00:03:27,910 --> 00:03:24,400

and where you are on the face of the

97

00:03:29,270 --> 00:03:27,920

earth with the 3d solar cell

98

00:03:31,589 --> 00:03:29,280

well excuse me with the planar solar

99

00:03:33,270 --> 00:03:31,599

cell they perform best at high noon

100

00:03:35,509 --> 00:03:33,280

where the incident flux is as

101  
00:03:37,910 --> 00:03:35,519  
perpendicular to the cell as possible

102  
00:03:40,550 --> 00:03:37,920  
with ours actually we want to be off

103  
00:03:42,550 --> 00:03:40,560  
angle slightly to allow for more photon

104  
00:03:43,910 --> 00:03:42,560  
impingements on within the the various

105  
00:03:45,509 --> 00:03:43,920  
different towers that

106  
00:03:48,789 --> 00:03:45,519  
were shown earlier with the various

107  
00:03:51,030 --> 00:03:48,799  
slides okay would this allow you to to

108  
00:03:53,910 --> 00:03:51,040  
get collect more electricity with a

109  
00:03:56,630 --> 00:03:53,920  
smaller cell set of cells yes it's

110  
00:03:58,309 --> 00:03:56,640  
really about the integrated energy from

111  
00:04:00,070 --> 00:03:58,319  
sunrise to sunset that we're able to

112  
00:04:03,030 --> 00:04:00,080  
capture because ours will go up whereas

113  
00:04:05,670 --> 00:04:03,040

the planar cell will always go down

114

00:04:08,390 --> 00:04:05,680

so that across the entire

115

00:04:10,390 --> 00:04:08,400

span of the sun rising to sun setting we

116

00:04:12,309 --> 00:04:10,400

absorb more more photons due to the

117

00:04:14,229 --> 00:04:12,319

light trapping we're also able to

118

00:04:17,349 --> 00:04:14,239

extract them better because our thin

119

00:04:19,830 --> 00:04:17,359

film absorber is significantly thinner

120

00:04:21,509 --> 00:04:19,840

because we're assured of the absorption

121

00:04:23,670 --> 00:04:21,519

so the carrier pathway getting the

122

00:04:25,749 --> 00:04:23,680

electrons out of the structure to create

123

00:04:27,110 --> 00:04:25,759

useful electricity

124

00:04:29,270 --> 00:04:27,120

is much shorter so there's a higher

125

00:04:31,270 --> 00:04:29,280

probability that they'll come out

126

00:04:33,270 --> 00:04:31,280

all right and uh have you heard any

127

00:04:34,469 --> 00:04:33,280

indications yet on when your experiment

128

00:04:37,430 --> 00:04:34,479

is going to fly

129

00:04:39,990 --> 00:04:37,440

um it's a 12-month program so it'll

130

00:04:43,110 --> 00:04:40,000

start in terms of making these things so

131

00:04:45,590 --> 00:04:43,120

that'll start i guess probably may 1st

132

00:04:47,749 --> 00:04:45,600

middle of april perhaps if we're lucky

133

00:04:49,030 --> 00:04:47,759

and then once we deliver it after 12

134

00:04:50,790 --> 00:04:49,040

months

135

00:04:52,310 --> 00:04:50,800

there'll be the integration that cases

136

00:04:53,670 --> 00:04:52,320

will perform

137

00:04:55,189 --> 00:04:53,680

i believe it's going up on a dragon

138

00:04:56,469 --> 00:04:55,199

vehicle that you've been showing it's a

139

00:04:59,189 --> 00:04:56,479

beautiful vehicle so i look forward to

140

00:05:00,629 --> 00:04:59,199

riding on that and um

141

00:05:02,390 --> 00:05:00,639

i have no idea how long it will take

142

00:05:04,150 --> 00:05:02,400

from when i get it in cases of hands to

143

00:05:05,590 --> 00:05:04,160

uh go to launch but i guarantee you'll

144

00:05:07,110 --> 00:05:05,600

be at the launch site watching it and

145

00:05:09,510 --> 00:05:07,120

cheering for it

146

00:05:11,590 --> 00:05:09,520

okay uh you know you mentioned that this

147

00:05:13,029 --> 00:05:11,600

was kind of a dream come true tell us a

148

00:05:14,550 --> 00:05:13,039

little bit about yourself where where

149

00:05:16,390 --> 00:05:14,560

did where were you born where'd you grow

150

00:05:18,230 --> 00:05:16,400

up and how did you get into space

151  
00:05:20,710 --> 00:05:18,240  
research um

152  
00:05:22,629 --> 00:05:20,720  
i am born in north carolina

153  
00:05:25,670 --> 00:05:22,639  
winston-salem but grew up in chapel hill

154  
00:05:27,270 --> 00:05:25,680  
um so go tar heels

155  
00:05:28,550 --> 00:05:27,280  
we've got

156  
00:05:30,070 --> 00:05:28,560  
space has always been a boyhood dream

157  
00:05:32,629 --> 00:05:30,080  
i've applied for the astronaut program

158  
00:05:34,150 --> 00:05:32,639  
since 99

159  
00:05:35,350 --> 00:05:34,160  
but

160  
00:05:36,550 --> 00:05:35,360  
it was beginning to look like i'm

161  
00:05:37,749 --> 00:05:36,560  
probably not going to be able to fly in

162  
00:05:38,469 --> 00:05:37,759  
space myself

163  
00:05:41,909 --> 00:05:38,479

so

164

00:05:43,990 --> 00:05:41,919

research up there that's a pretty good

165

00:05:45,749 --> 00:05:44,000

second prize but maybe by getting some

166

00:05:47,510 --> 00:05:45,759

experience here integrating this payload

167

00:05:49,670 --> 00:05:47,520

that maybe will up my chances a little

168

00:05:51,270 --> 00:05:49,680

bit farther in the selection process i

169

00:05:52,710 --> 00:05:51,280

got pretty far a couple a couple

170

00:05:54,230 --> 00:05:52,720

selections ago got to the reference

171

00:05:55,510 --> 00:05:54,240

stage but

172

00:05:57,670 --> 00:05:55,520

never an interview

173

00:05:59,110 --> 00:05:57,680

all right well and so it's interesting

174

00:06:01,510 --> 00:05:59,120

that this a lot of people don't know

175

00:06:03,590 --> 00:06:01,520

about cases and so uh

176  
00:06:07,350 --> 00:06:03,600  
we're talking about this because this is

177  
00:06:08,790 --> 00:06:07,360  
one way one avenue for researchers

178  
00:06:11,350 --> 00:06:08,800  
whether they're from an academic

179  
00:06:13,350 --> 00:06:11,360  
institution or for a commercial company

180  
00:06:14,950 --> 00:06:13,360  
or even individuals in some cases to get

181  
00:06:17,430 --> 00:06:14,960  
research on the international space

182  
00:06:18,870 --> 00:06:17,440  
station it is a u.s official national

183  
00:06:21,029 --> 00:06:18,880  
laboratory

184  
00:06:22,950 --> 00:06:21,039  
and so uh can you tell us a little bit

185  
00:06:25,110 --> 00:06:22,960  
about how working with cases has been

186  
00:06:27,590 --> 00:06:25,120  
yeah it's been great i mean it's it's

187  
00:06:29,909 --> 00:06:27,600  
just like you know working gonna be just

188  
00:06:32,230 --> 00:06:29,919

like if i went to oak ridge national lab

189

00:06:33,990 --> 00:06:32,240

to do do my research up there um

190

00:06:35,590 --> 00:06:34,000

battelle runs that for for the us

191

00:06:36,710 --> 00:06:35,600

government cases does the exact same

192

00:06:40,150 --> 00:06:36,720

thing for the international space

193

00:06:41,749 --> 00:06:40,160

station essentially um so it's been fun

194

00:06:45,110 --> 00:06:41,759

i'm just learning to meet

195

00:06:47,270 --> 00:06:45,120

all the people down there um so i plan

196

00:06:48,870 --> 00:06:47,280

actually i'm gonna be there in two weeks

197

00:06:50,629 --> 00:06:48,880

for uh spring break just happened to be

198

00:06:52,790 --> 00:06:50,639

down there with my daughter so maybe

199

00:06:54,790 --> 00:06:52,800

we'll zip over to the to the cape to to

200

00:06:56,790 --> 00:06:54,800

see them and see the place

201  
00:06:58,070 --> 00:06:56,800  
all right well judd reedy thank you so

202  
00:07:00,390 --> 00:06:58,080  
much for joining us today and

203  
00:07:01,670 --> 00:07:00,400  
congratulation on your experiment being

204  
00:07:03,430 --> 00:07:01,680  
selected for

205  
00:07:04,710 --> 00:07:03,440  
tests on the international space station

206  
00:07:06,710 --> 00:07:04,720  
we'll look forward to hearing the

207  
00:07:09,430 --> 00:07:06,720  
results of your research thank you very

208  
00:07:11,990 --> 00:07:09,440  
much kelly i appreciate it

209  
00:07:13,909 --> 00:07:12,000  
all right that was judd reedy uh who is

210  
00:07:15,909 --> 00:07:13,919  
working with an experiment that's been

211  
00:07:18,070 --> 00:07:15,919  
selected now by the center for the

212  
00:07:19,589 --> 00:07:18,080  
advancement of science and space

213  
00:07:21,830 --> 00:07:19,599

to fly on the international space

214

00:07:23,589 --> 00:07:21,840

station in a year or so that's going to

215

00:07:25,909 --> 00:07:23,599

look at how to make

216

00:07:27,749 --> 00:07:25,919

better and three-dimensional