

S:  
rs

gh  
ll

S



**Julie Williams-Byrd**  
NASA Senior Systems Analyst

1  
00:00:11,749 --> 00:00:08,799  
equilateral trapezoid isosceles

2  
00:00:14,600 --> 00:00:11,759  
tetrahedron I have never seen a mind

3  
00:00:24,980 --> 00:00:14,610  
like the one your daughter has you have

4  
00:00:26,599 --> 00:00:24,990  
to see what she becomes Katherine we all

5  
00:00:28,310 --> 00:00:26,609  
go end up unemployed riding around in

6  
00:00:30,740 --> 00:00:28,320  
this pile of junk you're welcome to walk

7  
00:00:34,880 --> 00:00:30,750  
the sixteen men all sit in the back of

8  
00:00:36,799 --> 00:00:34,890  
the bus you have identification on we

9  
00:00:40,040 --> 00:00:36,809  
just don't know where to work at NASA

10  
00:00:44,869 --> 00:00:40,050  
sir I had no idea they heard quite a few

11  
00:00:46,639 --> 00:00:44,879  
women working in the space program you

12  
00:00:48,680 --> 00:00:46,649  
know we're doing here we're putting a

13  
00:00:52,030 --> 00:00:48,690

human on top of a missile shooting into

14

00:00:56,230 --> 00:00:54,130

I need a mathematician it could look

15

00:00:58,270 --> 00:00:56,240

beyond the numbers man that doesn't yet

16

00:01:02,160 --> 00:00:58,280

exist before the Russians plant a flag

17

00:01:04,780 --> 00:01:02,170

from the damnum you have someone running

18

00:01:06,490 --> 00:01:04,790

Kathir as a gal for that she can handle

19

00:01:08,710 --> 00:01:06,500

any numbers you put in wrong don't

20

00:01:13,840 --> 00:01:08,720

embarrass me this was an indeed last

21

00:01:16,660 --> 00:01:13,850

night sorry I'm not that carnal Jam is a

22

00:01:18,460 --> 00:01:16,670

tall glass of water it's coming over now

23

00:01:21,880 --> 00:01:18,470

why would he be doing that Kells Mary's

24

00:01:27,070 --> 00:01:21,890

waving it Oh Jonathan slice up a file of

25

00:01:29,350 --> 00:01:27,080

what you already have a slam Hanoi your

26  
00:01:33,760 --> 00:01:29,360  
computer at nest and then women handle

27  
00:01:36,640 --> 00:01:33,770  
that sorted yes yes that women do some

28  
00:01:39,730 --> 00:01:36,650  
things at NASA mr. Johnson and it's not

29  
00:01:43,389 --> 00:01:39,740  
because we'll be escapes it's because we

30  
00:01:45,670 --> 00:01:43,399  
wear glasses we go from being our

31  
00:01:48,430 --> 00:01:45,680  
fathers daughters to our husbands wives

32  
00:01:51,310 --> 00:01:48,440  
to our babies mothers every night for

33  
00:01:53,830 --> 00:01:51,320  
three hundred out with Mama gone for 12

34  
00:01:57,050 --> 00:01:53,840  
and a half days no but it felt like it

35  
00:02:03,380 --> 00:02:00,380  
it's crunch time in 14 days astronauts

36  
00:02:05,180 --> 00:02:03,390  
will be here for training everything we

37  
00:02:06,770 --> 00:02:05,190  
do can matter to their wives to their

38  
00:02:08,809 --> 00:02:06,780

children I believe is gonna matter to

39

00:02:12,199 --> 00:02:08,819

the whole damn country my gals are ready

40

00:02:14,090 --> 00:02:12,209

we can do the work that's John Glenn

41

00:02:16,460 --> 00:02:14,100

what do you ladies do for NASA calculate

42

00:02:17,780 --> 00:02:16,470

your margin landing sir engineer and I'm

43

00:02:20,540 --> 00:02:17,790

proud as the devil to be working with

44

00:02:22,850 --> 00:02:20,550

you how could you possibly be uh Glenn

45

00:02:26,809 --> 00:02:22,860

these white men it's equal rights I have

46

00:02:28,460 --> 00:02:26,819

no right as you find in epic there is no

47

00:02:29,930 --> 00:02:28,470

protocol for women attending there's no

48

00:02:31,640 --> 00:02:29,940

protocol for man circling the Earth

49

00:02:33,170 --> 00:02:31,650

either sir every time we have a chance

50

00:02:36,050 --> 00:02:33,180

to get ahead they move to finish me

51  
00:02:40,580 --> 00:02:36,060  
every time we all get there together we

52  
00:02:42,470 --> 00:02:40,590  
don't get there at all give it no uh

53  
00:02:45,320 --> 00:02:42,480  
NASA and giving up on good old-fashioned

54  
00:02:45,330 --> 00:02:51,240  
do

55  
00:02:55,980 --> 00:02:53,820  
let me ask you if you were white male

56  
00:02:59,420 --> 00:02:55,990  
would you wish to be an engineer I

57  
00:03:07,860 --> 00:02:59,430  
wouldn't have to I'd already be them

58  
00:03:10,230 --> 00:03:07,870  
don't you know that we're able good

59  
00:03:12,780 --> 00:03:10,240  
morning welcome to hidden figures the

60  
00:03:14,910 --> 00:03:12,790  
story behind the story my name is Sarah

61  
00:03:17,820 --> 00:03:14,920  
Ramsey and I'm your moderator for this

62  
00:03:19,800 --> 00:03:17,830  
event celebrating NASA's history hidden

63  
00:03:22,350 --> 00:03:19,810

figures tells the story of the early

64  
00:03:24,630 --> 00:03:22,360  
days of NASA when computers were people

65  
00:03:26,820 --> 00:03:24,640  
and specifically the story of the women

66  
00:03:29,280 --> 00:03:26,830  
who broke barriers both at NASA and in

67  
00:03:31,650 --> 00:03:29,290  
society we've got a great panel here

68  
00:03:34,290 --> 00:03:31,660  
today to talk about this story and the

69  
00:03:35,550 --> 00:03:34,300  
story behind the story joining us in

70  
00:03:38,520 --> 00:03:35,560  
just a few minutes will be NASA

71  
00:03:40,770 --> 00:03:38,530  
Administrator Charles Bolden and then we

72  
00:03:44,190 --> 00:03:40,780  
have dr. bill Barry who is NASA's chief

73  
00:03:46,890 --> 00:03:44,200  
historian and Julie Williams Byrd who is

74  
00:03:49,080 --> 00:03:46,900  
a senior systems analyst here at NASA's

75  
00:03:51,660 --> 00:03:49,090  
Langley Research Center and then joining

76

00:03:54,510 --> 00:03:51,670

us virtually is Ted Nell fee who

77

00:03:58,259 --> 00:03:54,520

directed the new film hidden figures hi

78

00:03:59,509 --> 00:03:58,269

Ted I'd like to encourage you watching

79

00:04:02,460 --> 00:03:59,519

out there to send in your questions

80

00:04:06,150 --> 00:04:02,470

during the program you can email those

81

00:04:07,949 --> 00:04:06,160

questions to d/l info channel at

82

00:04:15,360 --> 00:04:07,959

gmail.com

83

00:04:17,280 --> 00:04:15,370

let's start with you the women in this

84

00:04:19,500 --> 00:04:17,290

story they played a critical role in

85

00:04:21,570 --> 00:04:19,510

NASA's history can you tell us a little

86

00:04:24,060 --> 00:04:21,580

bit about what they did and why it was

87

00:04:25,980 --> 00:04:24,070

important then well Becky you have to

88

00:04:28,560 --> 00:04:25,990

remember the context of the situation

89

00:04:30,900 --> 00:04:28,570  
you know we're dealing with the Cold War

90

00:04:32,640 --> 00:04:30,910  
situation you know time long ago for

91

00:04:36,270 --> 00:04:32,650  
most people who were going to watch the

92

00:04:37,650 --> 00:04:36,280  
movie but it was a very tense period of

93

00:04:39,390 --> 00:04:37,660  
time between the United States and the

94

00:04:43,640 --> 00:04:39,400  
Soviet Union and being competitors the

95

00:04:45,810 --> 00:04:43,650  
space race became a surrogate for a

96

00:04:47,909 --> 00:04:45,820  
struggle between those two countries and

97

00:04:49,950 --> 00:04:47,919  
so what was happening at NASA was

98

00:04:52,350 --> 00:04:49,960  
critical to the country President

99

00:04:54,150 --> 00:04:52,360  
Kennedy set the goal to land on the moon

100

00:04:57,300 --> 00:04:54,160  
in part that proved that the United

101  
00:04:58,530 --> 00:04:57,310  
States had a viable socio-economic

102  
00:04:59,850 --> 00:04:58,540  
system because people actually thought

103  
00:05:01,230 --> 00:04:59,860  
that the Soviet system might be better

104  
00:05:05,050 --> 00:05:01,240  
than the u.s. one because they were so

105  
00:05:06,310 --> 00:05:05,060  
successful in space so what the

106  
00:05:07,690 --> 00:05:06,320  
all people at Assen we're doing but

107  
00:05:09,520 --> 00:05:07,700  
particularly the computers who were

108  
00:05:12,550 --> 00:05:09,530  
working here that Langley at the time

109  
00:05:14,020 --> 00:05:12,560  
we're doing was they were you know

110  
00:05:15,250 --> 00:05:14,030  
calculating all the important

111  
00:05:17,200 --> 00:05:15,260  
information that needed to be done to

112  
00:05:19,570 --> 00:05:17,210  
find out how we going to actually do

113  
00:05:22,810 --> 00:05:19,580

that stuff we have done this before and

114

00:05:24,280 --> 00:05:22,820

so those calculations were absolutely

115

00:05:26,260 --> 00:05:24,290

critical to understanding how we're

116

00:05:28,810 --> 00:05:26,270

going to safely put people in and out of

117

00:05:31,230 --> 00:05:28,820

space and and that was a really critical

118

00:05:35,890 --> 00:05:31,240

role for for NASA and for our country

119

00:05:39,730 --> 00:05:35,900

great administrator bolden welcome good

120

00:05:41,650 --> 00:05:39,740

to be here if I can start you off with

121

00:05:44,020 --> 00:05:41,660

the question here we've learned a little

122

00:05:46,570 --> 00:05:44,030

bit about the history and I know that as

123

00:05:47,920 --> 00:05:46,580

a pilot in an astronaut you understand

124

00:05:51,879 --> 00:05:47,930

the importance of science and math and

125

00:05:54,370 --> 00:05:51,889

how NASA uses those but I know you also

126

00:05:56,500 --> 00:05:54,380

feel strongly about how the arts and

127

00:05:58,300 --> 00:05:56,510

about how history is important to us at

128

00:06:00,850 --> 00:05:58,310

NASA so can you tell us a little bit

129

00:06:02,950 --> 00:06:00,860

about how those subjects fit into what

130

00:06:05,440 --> 00:06:02,960

we do well we think they fit incredibly

131

00:06:07,240 --> 00:06:05,450

well because I think I firmly believe

132

00:06:09,430 --> 00:06:07,250

that young people like the ones in the

133

00:06:12,460 --> 00:06:09,440

audience some of them don't have a clue

134

00:06:14,500 --> 00:06:12,470

that they like math and science but they

135

00:06:16,779 --> 00:06:14,510

know that they like music or they know

136

00:06:19,690 --> 00:06:16,789

they like art or they know they like

137

00:06:21,610 --> 00:06:19,700

something else and and we know that arts

138

00:06:24,640 --> 00:06:21,620

come from the same side of the brain as

139

00:06:27,760 --> 00:06:24,650

math and science so at NASA we talk

140

00:06:30,430 --> 00:06:27,770

about steamed which is science

141

00:06:33,130 --> 00:06:30,440

technology engineering arts math and

142

00:06:35,800 --> 00:06:33,140

then we had a D for design and and you

143

00:06:37,690 --> 00:06:35,810

may say well what's design design of

144

00:06:39,960 --> 00:06:37,700

spacesuit design is the interior or

145

00:06:42,310 --> 00:06:39,970

cockpit of a spacecraft so we emphasize

146

00:06:44,800 --> 00:06:42,320

all of those things and that's why the

147

00:06:47,740 --> 00:06:44,810

arts are so important to us if you talk

148

00:06:49,300 --> 00:06:47,750

about the movie that we're going to talk

149

00:06:52,900 --> 00:06:49,310

about a little bit later you may have

150

00:06:54,790 --> 00:06:52,910

already started talking about you notice

151  
00:06:58,750 --> 00:06:54,800  
how the arts enable us to become

152  
00:07:01,210 --> 00:06:58,760  
storytellers Sir Rebecca here my good

153  
00:07:02,830 --> 00:07:01,220  
friend of many many years knows that one

154  
00:07:05,050 --> 00:07:02,840  
of my the things that I say all the time

155  
00:07:06,909 --> 00:07:05,060  
about about us NASA engineers and

156  
00:07:08,800 --> 00:07:06,919  
scientists not about people like her she

157  
00:07:10,330 --> 00:07:08,810  
is a tremendous communicator we have I

158  
00:07:12,010 --> 00:07:10,340  
think we have the best communications

159  
00:07:14,380 --> 00:07:12,020  
shop in the world

160  
00:07:15,640 --> 00:07:14,390  
it's people like me the engineers and

161  
00:07:17,980 --> 00:07:15,650  
scientists who don't know how to tell

162  
00:07:20,500 --> 00:07:17,990  
stories and so that's again where

163  
00:07:22,090 --> 00:07:20,510

arts come in so for some of you again in

164

00:07:24,040 --> 00:07:22,100

the audience you may think what am I

165

00:07:25,630 --> 00:07:24,050

going to do with the space program you

166

00:07:27,730 --> 00:07:25,640

can be a storyteller you know you can

167

00:07:30,250 --> 00:07:27,740

help us to tell our story you can do

168

00:07:32,080 --> 00:07:30,260

what dr. bill berry does he is the

169

00:07:35,620 --> 00:07:32,090

consummate storyteller for NASA is the

170

00:07:39,040 --> 00:07:35,630

NASA historian so he is in his brain and

171

00:07:41,770 --> 00:07:39,050

in and in his office back at NASA

172

00:07:45,100 --> 00:07:41,780

headquarters in Washington DC resides

173

00:07:46,060 --> 00:07:45,110

the entire history not just a NASA the

174

00:07:49,390 --> 00:07:46,070

National Aeronautics and Space

175

00:07:51,730 --> 00:07:49,400

Administration but of NACA the the

176

00:07:54,790 --> 00:07:51,740

National Advisory Committee on

177

00:07:57,550 --> 00:07:54,800

Aeronautics which is what brought us if

178

00:08:01,000 --> 00:07:57,560

you will Katherine Johnson and you know

179

00:08:05,200 --> 00:08:01,010

the computers and skirts all right Thank

180

00:08:09,490 --> 00:08:05,210

You Julie you've worked at NASA now for

181

00:08:11,770 --> 00:08:09,500

28 years yes and would you tell us a

182

00:08:13,690 --> 00:08:11,780

little bit about your story and what

183

00:08:15,970 --> 00:08:13,700

inspired you to pursue a career in

184

00:08:18,670 --> 00:08:15,980

science and engineering sure I'd love to

185

00:08:22,420 --> 00:08:18,680

so as you said Sara I've been here at

186

00:08:24,280 --> 00:08:22,430

NASA Langley for 28 years I have a

187

00:08:27,300 --> 00:08:24,290

degree in physics from Hampton

188

00:08:30,910 --> 00:08:27,310

University and the things that I do now

189

00:08:33,100 --> 00:08:30,920

things that help NASA look at sending

190

00:08:35,110 --> 00:08:33,110

humans to Mars so the journey to Mars is

191

00:08:36,460 --> 00:08:35,120

the work that I do and so I look at

192

00:08:39,250 --> 00:08:36,470

different technologies and capabilities

193

00:08:41,440 --> 00:08:39,260

that we'll need to send humans to Mars

194

00:08:43,870 --> 00:08:41,450

and it's really quite exciting and quite

195

00:08:45,880 --> 00:08:43,880

challenging to think about sending

196

00:08:47,470 --> 00:08:45,890

humans safely to Mars and so the work

197

00:08:50,410 --> 00:08:47,480

that I do is really really really very

198

00:08:52,360 --> 00:08:50,420

exciting how I got here and I tell the

199

00:08:54,160 --> 00:08:52,370

story wherever I go I talk about my dad

200

00:08:56,530 --> 00:08:54,170

who was just the most phenomenal person

201  
00:08:58,810 --> 00:08:56,540  
in the whole wide world you can tell we

202  
00:09:01,750 --> 00:08:58,820  
were very very very close but I remember

203  
00:09:03,100 --> 00:09:01,760  
in high school my dad was talking to me

204  
00:09:05,650 --> 00:09:03,110  
and he said Julie you know you're really

205  
00:09:08,410 --> 00:09:05,660  
good at math and I think that you would

206  
00:09:11,650 --> 00:09:08,420  
be a really good engineer in high school

207  
00:09:13,030 --> 00:09:11,660  
I wasn't focused on engineering I was

208  
00:09:15,160 --> 00:09:13,040  
thinking about maybe a law degree but

209  
00:09:17,320 --> 00:09:15,170  
when dad said that that one moment it

210  
00:09:19,300 --> 00:09:17,330  
clicked in my heart because I was very

211  
00:09:21,280 --> 00:09:19,310  
good at math and I really enjoyed math

212  
00:09:24,070 --> 00:09:21,290  
it almost came to me very naturally and

213  
00:09:25,810 --> 00:09:24,080

so when dad said that I said well if dad

214

00:09:28,960 --> 00:09:25,820

says I can do it then I must be able to

215

00:09:30,730 --> 00:09:28,970

do it so I forged that path and came

216

00:09:31,340 --> 00:09:30,740

here like I said I went to school at at

217

00:09:33,380 --> 00:09:31,350

ham

218

00:09:35,930 --> 00:09:33,390

université I had a lot of instructors

219

00:09:37,940 --> 00:09:35,940

and professors that saw things in me

220

00:09:39,080 --> 00:09:37,950

that I didn't see and then talking to

221

00:09:40,490 --> 00:09:39,090

these young folks there's going to be

222

00:09:42,530 --> 00:09:40,500

people that are going to speak

223

00:09:44,120 --> 00:09:42,540

encouraging words on you and they're

224

00:09:45,470 --> 00:09:44,130

going to see things in you that you

225

00:09:47,660 --> 00:09:45,480

don't quite see in yourselves right now

226

00:09:50,570 --> 00:09:47,670

and I encourage you to take those words

227

00:09:53,330 --> 00:09:50,580

and to build on them and to realize your

228

00:09:55,340 --> 00:09:53,340

goal and so like I said working here at

229

00:09:56,630 --> 00:09:55,350

NASA Langley has been a dream it really

230

00:09:58,880 --> 00:09:56,640

really has been a dream when I first

231

00:10:01,340 --> 00:09:58,890

started working here I was developing

232

00:10:02,690 --> 00:10:01,350

solid state lasers for remote sensing of

233

00:10:04,910 --> 00:10:02,700

the atmosphere it's always in the

234

00:10:06,470 --> 00:10:04,920

research lab and a laser lab doing that

235

00:10:08,930 --> 00:10:06,480

work and that was really really cool and

236

00:10:10,400 --> 00:10:08,940

then I switched over to systems analysis

237

00:10:12,350 --> 00:10:10,410

where we look at different technologies

238

00:10:15,710 --> 00:10:12,360

and capabilities for NASA's journey to

239

00:10:18,380 --> 00:10:15,720

Mars fantastic thanks Julie all right

240

00:10:23,000 --> 00:10:18,390

let's go to our virtual participant Ted

241

00:10:26,270 --> 00:10:23,010

milfy hi Ted good morning I

242

00:10:28,730 --> 00:10:26,280

so obviously the story of hidden figures

243

00:10:31,490 --> 00:10:28,740

inspired you and can you tell us a

244

00:10:33,380 --> 00:10:31,500

little bit more about how you discovered

245

00:10:37,790 --> 00:10:33,390

the story and why you decided it needed

246

00:10:40,070 --> 00:10:37,800

to be a film well it started with a book

247

00:10:43,370 --> 00:10:40,080

proposal done by the Marguerite sherry

248

00:10:47,630 --> 00:10:43,380

Morrow was Margo's father was a research

249

00:10:50,540 --> 00:10:47,640

scientist at NASA for many years and he

250

00:10:53,780 --> 00:10:50,550

grew up in Langley in the Langley campus

251  
00:10:56,030 --> 00:10:53,790  
in Virginia and Margo therefore grew up

252  
00:10:59,240 --> 00:10:56,040  
with Katherine Johnson around and

253  
00:11:02,350 --> 00:10:59,250  
Dorothy Vaughn and Mary Jackson and she

254  
00:11:04,490 --> 00:11:02,360  
started researching these women and

255  
00:11:06,980 --> 00:11:04,500  
discovering the history of these women

256  
00:11:10,190 --> 00:11:06,990  
along with the help from NASA and dr.

257  
00:11:11,780 --> 00:11:10,200  
Bell and she discovered this amazing

258  
00:11:13,970 --> 00:11:11,790  
story about these women if you if you

259  
00:11:15,590 --> 00:11:13,980  
guys don't know this you guys have

260  
00:11:17,270 --> 00:11:15,600  
computers all the students out there you

261  
00:11:20,150 --> 00:11:17,280  
guys have computers but back in their

262  
00:11:23,330 --> 00:11:20,160  
day a human being was called a computer

263  
00:11:25,850 --> 00:11:23,340

so these women were called computers

264

00:11:26,150 --> 00:11:25,860

before we had laptops or anything like

265

00:11:29,570 --> 00:11:26,160

that

266

00:11:31,490 --> 00:11:29,580

so she wrote this book proposal which

267

00:11:34,100 --> 00:11:31,500

was just so fascinating about these

268

00:11:35,269 --> 00:11:34,110

three women who were going through NASA

269

00:11:37,129 --> 00:11:35,279

at the time and

270

00:11:40,280 --> 00:11:37,139

and working at NASA and helping the

271

00:11:43,639 --> 00:11:40,290

astronauts in the space race in 1960s

272

00:11:45,829 --> 00:11:43,649

and they were just an incredible journey

273

00:11:48,650 --> 00:11:45,839

together and when you read this book

274

00:11:52,249 --> 00:11:48,660

proposal you you couldn't believe first

275

00:11:53,960 --> 00:11:52,259

of all that the story was true that that

276

00:11:55,910 --> 00:11:53,970

there actually were women that work at

277

00:11:57,829 --> 00:11:55,920

NASA at that time I worked in math and

278

00:12:02,090 --> 00:11:57,839

science at that time because back in

279

00:12:04,489 --> 00:12:02,100

those days a woman could get a job as a

280

00:12:06,019 --> 00:12:04,499

nurse or a teacher and so working at

281

00:12:08,509 --> 00:12:06,029

NASA was a great place for them and a

282

00:12:09,799 --> 00:12:08,519

great step up so the story was just so

283

00:12:12,350 --> 00:12:09,809

captivating and I have two daughters

284

00:12:15,139 --> 00:12:12,360

myself pretty much the same age as most

285

00:12:16,970 --> 00:12:15,149

of you guys out there so it was very

286

00:12:21,309 --> 00:12:16,980

very it was just this an amazing true

287

00:12:27,290 --> 00:12:24,860

fantastic thank you all right so we are

288

00:12:28,699 --> 00:12:27,300

going to take questions from students in

289

00:12:31,549 --> 00:12:28,709

our audience both here in the studio

290

00:12:32,299 --> 00:12:31,559

with us and tying in through our Digital

291

00:12:35,540 --> 00:12:32,309

Learning Network

292

00:12:39,019 --> 00:12:35,550

but just as a reminder you can send your

293

00:12:42,110 --> 00:12:39,029

questions to us at DL info channel at

294

00:12:49,540 --> 00:12:42,120

gmail.com but first we'd like to hear

295

00:12:49,550 --> 00:12:53,929

all right

296

00:12:59,359 --> 00:12:57,319

hi I'm taraji P Henson and my new movie

297

00:13:01,669 --> 00:12:59,369

hidden figures we learn about the

298

00:13:03,799 --> 00:13:01,679

brilliant african-american women who

299

00:13:05,960 --> 00:13:03,809

used their brains to make space travel

300

00:13:08,179 --> 00:13:05,970

possible their groundbreaking

301  
00:13:10,429 --> 00:13:08,189  
accomplishments are an important

302  
00:13:13,189 --> 00:13:10,439  
reminder for all of us to learn STEM

303  
00:13:16,069 --> 00:13:13,199  
science technology engineering and

304  
00:13:18,649 --> 00:13:16,079  
mathematics these skills will make it

305  
00:13:21,469 --> 00:13:18,659  
possible for women and minorities to get

306  
00:13:23,599 --> 00:13:21,479  
careers we've only dreamed of like the

307  
00:13:28,159 --> 00:13:23,609  
women of hidden figures you too could

308  
00:13:30,619 --> 00:13:28,169  
change the world thank you now let's go

309  
00:13:32,239 --> 00:13:30,629  
to our first question here in our studio

310  
00:13:34,549 --> 00:13:32,249  
audience we've got some students from

311  
00:13:36,009 --> 00:13:34,559  
Bethel High School joining us today so

312  
00:13:39,109 --> 00:13:36,019  
let's go to our first question

313  
00:13:42,349 --> 00:13:39,119

hello my name is Anil Ola Pataki and my

314

00:13:44,629 --> 00:13:42,359

question is for dr. Barry what was the

315

00:13:46,210 --> 00:13:44,639

required background of the three ladies

316

00:13:49,939 --> 00:13:46,220

that were hired for the positions

317

00:13:51,710 --> 00:13:49,949

highlighted in the movie so to be a

318

00:13:54,379 --> 00:13:51,720

computer for the NACA the National

319

00:13:58,809 --> 00:13:54,389

Advisory Committee for Aeronautics back

320

00:14:00,919 --> 00:13:58,819

in in those days typically it wasn't the

321

00:14:03,319 --> 00:14:00,929

engineering level job so you didn't have

322

00:14:06,139 --> 00:14:03,329

to have a college degree and many of the

323

00:14:08,960 --> 00:14:06,149

first woman computers were hired by the

324

00:14:10,159 --> 00:14:08,970

Langley folks here starting in 1935 when

325

00:14:12,739 --> 00:14:10,169

the first woman computers were brought

326

00:14:14,179 --> 00:14:12,749

in many of them were they were college

327

00:14:17,139 --> 00:14:14,189

graduates they as a math background but

328

00:14:18,979 --> 00:14:17,149

but not a lot in 1943 when the first

329

00:14:21,949 --> 00:14:18,989

african-american woman computers were

330

00:14:23,960 --> 00:14:21,959

brought in they brought in some very

331

00:14:25,399 --> 00:14:23,970

qualified people they all had advanced

332

00:14:27,710 --> 00:14:25,409

they all had college degrees of

333

00:14:29,299 --> 00:14:27,720

mathematics they're all extremely bright

334

00:14:32,359 --> 00:14:29,309

and they had a network of people that

335

00:14:33,919 --> 00:14:32,369

that they went to to find their friends

336

00:14:36,559 --> 00:14:33,929

who were also equally you know qualified

337

00:14:37,579 --> 00:14:36,569

so so the african-american woman

338

00:14:39,049 --> 00:14:37,589

computers came were actually more

339

00:14:42,949 --> 00:14:39,059

qualified than their white counterparts

340

00:14:46,699 --> 00:14:42,959

who worked in NAC at the time and and so

341

00:14:48,919 --> 00:14:46,709

they naturally flourished at the NACA

342

00:14:51,589 --> 00:14:48,929

it's an engineering institution as we

343

00:14:53,869 --> 00:14:51,599

are here at NASA now and data drives

344

00:14:54,799 --> 00:14:53,879

decisions and when you look at the data

345

00:14:56,960 --> 00:14:54,809

it's like these people are producing

346

00:14:59,479 --> 00:14:56,970

they're doing great work we need to give

347

00:15:01,879 --> 00:14:59,489

them more work so so that's what happens

348

00:15:03,799 --> 00:15:01,889

so typically most computers had some

349

00:15:04,580 --> 00:15:03,809

math background we're talented in some

350

00:15:06,710 --> 00:15:04,590

way

351  
00:15:08,750 --> 00:15:06,720  
math all the african-american women who

352  
00:15:11,060 --> 00:15:08,760  
came into actually had at least a

353  
00:15:12,770 --> 00:15:11,070  
bachelor's degree in in mathematics and

354  
00:15:15,200 --> 00:15:12,780  
we're incredibly qualified many were

355  
00:15:16,510 --> 00:15:15,210  
extremely brilliant and gifted in many

356  
00:15:19,670 --> 00:15:16,520  
many ways

357  
00:15:22,340 --> 00:15:19,680  
great thank you all right we're going to

358  
00:15:25,460 --> 00:15:22,350  
go to our deal in now and we're going to

359  
00:15:26,570 --> 00:15:25,470  
go to our first high school bland County

360  
00:15:31,460 --> 00:15:26,580  
High School

361  
00:15:35,720 --> 00:15:31,470  
bland County are you I say hi to

362  
00:15:39,770 --> 00:15:35,730  
everyone give them just a second here to

363  
00:15:42,470 --> 00:15:39,780

get online and we'll let them say hi and

364

00:15:47,660 --> 00:15:42,480

then we will have them ask their

365

00:15:49,460 --> 00:15:47,670

question all right so after bland County

366

00:15:57,440 --> 00:15:49,470

we're going to go to Avon intermediate

367

00:15:59,840 --> 00:15:57,450

West so you guys get ready and we'll

368

00:16:03,460 --> 00:15:59,850

take a question actually

369

00:16:09,830 --> 00:16:03,470

we've got a couple of questions from

370

00:16:11,450 --> 00:16:09,840

town all right we're gonna go to a

371

00:16:13,130 --> 00:16:11,460

question from our studio audience here

372

00:16:17,329 --> 00:16:13,140

so while we're getting blamed pounding

373

00:16:21,900 --> 00:16:20,190

to kill the last to check the

374

00:16:23,730 --> 00:16:21,910

calculations of the human computers and

375

00:16:27,960 --> 00:16:23,740

how would you guys determine which

376

00:16:29,250 --> 00:16:27,970

calculations were Valley that's a great

377

00:16:30,480 --> 00:16:29,260

question and when you see the movie

378

00:16:32,400 --> 00:16:30,490

you'll see that that plays an important

379

00:16:36,090 --> 00:16:32,410

role in the movie is lauded as this Ted

380

00:16:39,389 --> 00:16:36,100

will tell us as well but of course in

381

00:16:41,310 --> 00:16:39,399

the 1930s and 40s the computers really

382

00:16:43,019 --> 00:16:41,320

didn't exist in any you know electronic

383

00:16:45,720 --> 00:16:43,029

computers didn't exist yet and they were

384

00:16:48,720 --> 00:16:45,730

just being developed the NACA bought its

385

00:16:50,880 --> 00:16:48,730

first computer in the late 1940s and it

386

00:16:53,370 --> 00:16:50,890

was one of these giant room sized univac

387

00:16:56,579 --> 00:16:53,380

computers it took a very long time to

388

00:16:58,620 --> 00:16:56,589

program it to tell it what to do and so

389

00:17:01,500 --> 00:16:58,630

it wasn't used very much and it wasn't

390

00:17:02,940 --> 00:17:01,510

until the nineteen in the 50s that the

391

00:17:05,159 --> 00:17:02,950

computers started being used for

392

00:17:07,319 --> 00:17:05,169

scientific research but they were again

393

00:17:08,789 --> 00:17:07,329

slow not highly reliable you'd have to

394

00:17:10,530 --> 00:17:08,799

have a human computer check to make sure

395

00:17:12,890 --> 00:17:10,540

that the calculations were correct

396

00:17:16,949 --> 00:17:12,900

before you ran your run on the computer

397

00:17:18,480 --> 00:17:16,959

and and getting time on them was was

398

00:17:21,539 --> 00:17:18,490

limited because there's so few of them

399

00:17:24,000 --> 00:17:21,549

so electronic computers really didn't

400

00:17:26,069 --> 00:17:24,010

play a role until early 60s and

401  
00:17:28,140 --> 00:17:26,079  
fortunately for us they became more

402  
00:17:29,909 --> 00:17:28,150  
usable in the 60s because you needed

403  
00:17:31,830 --> 00:17:29,919  
electronic computers to calculate things

404  
00:17:33,240 --> 00:17:31,840  
very quickly for space flight you really

405  
00:17:35,280 --> 00:17:33,250  
you really can't do spaceflight without

406  
00:17:37,500 --> 00:17:35,290  
electronic computers so electronic

407  
00:17:39,150 --> 00:17:37,510  
appears just coming out as we're

408  
00:17:40,799 --> 00:17:39,160  
starting to send humans into space good

409  
00:17:44,570 --> 00:17:40,809  
time it those things merge together well

410  
00:17:46,799 --> 00:17:44,580  
and as you'll see in the movie the the

411  
00:17:48,720 --> 00:17:46,809  
question of whether the software that

412  
00:17:51,480 --> 00:17:48,730  
that calculated John Glenn's trajectory

413  
00:17:53,280 --> 00:17:51,490

correct was the correct software was a

414

00:17:55,950 --> 00:17:53,290

question and were the computers

415

00:17:58,820 --> 00:17:55,960

producing the right data and Katherine

416

00:18:00,720 --> 00:17:58,830

Johnson played a critical role in

417

00:18:04,880 --> 00:18:00,730

proving that in fact the software that

418

00:18:06,930 --> 00:18:04,890

we're using for John Glenn's flight was

419

00:18:10,650 --> 00:18:06,940

accurate and produced the right answers

420

00:18:12,990 --> 00:18:10,660

I I want to challenge all of you okay

421

00:18:15,720 --> 00:18:13,000

pay attention to the movie remember his

422

00:18:17,909 --> 00:18:15,730

question and then at the end if I find

423

00:18:21,240 --> 00:18:17,919

you all I'm going to ask you what was

424

00:18:23,700 --> 00:18:21,250

the lesson that you learned from what

425

00:18:25,740 --> 00:18:23,710

happened between humans and computers

426

00:18:28,409 --> 00:18:25,750

over the course of the movie that's

427

00:18:31,049 --> 00:18:28,419

applicable to today okay

428

00:18:33,240 --> 00:18:31,059

we should be learning from things like

429

00:18:34,860 --> 00:18:33,250

this book in this movie there's a very

430

00:18:37,260 --> 00:18:34,870

important lesson I think that's

431

00:18:38,640 --> 00:18:37,270

applicable to today to all of you so I'm

432

00:18:41,700 --> 00:18:38,650

gonna ask you about it after you see the

433

00:18:43,549 --> 00:18:41,710

movie excellent I felt like we should

434

00:18:48,360 --> 00:18:43,559

have put a spoiler alert

435

00:18:50,480 --> 00:18:48,370

sorry said alright um let's see if we've

436

00:18:53,010 --> 00:18:50,490

got bland County we're going to go

437

00:18:55,860 --> 00:18:53,020

actually I've got a question from from

438

00:18:59,700 --> 00:18:55,870

Gmail so let's take one of our submitted

439

00:19:00,990 --> 00:18:59,710

questions because I think this is

440

00:19:03,360 --> 00:19:01,000

actually a really great question and

441

00:19:05,610 --> 00:19:03,370

Charlie this one I think you might want

442

00:19:07,860 --> 00:19:05,620

to answer how many people does it take

443

00:19:10,440 --> 00:19:07,870

to build a rocket today thousands

444

00:19:12,780 --> 00:19:10,450

literally thousands and thousands and

445

00:19:16,500 --> 00:19:12,790

thousands of people to build a rocket in

446

00:19:18,140 --> 00:19:16,510

NASA we have 17,000 give or take civil

447

00:19:21,150 --> 00:19:18,150

servants who are employees and about

448

00:19:23,820 --> 00:19:21,160

40,000 contractors that support us now

449

00:19:25,230 --> 00:19:23,830

they're not all working on say the heavy

450

00:19:27,720 --> 00:19:25,240

lift launch vehicle that we're building

451  
00:19:29,159 --> 00:19:27,730  
to carry humans to Mars some of them are

452  
00:19:30,780 --> 00:19:29,169  
working on the capsule some of them are

453  
00:19:32,190 --> 00:19:30,790  
working on the ground systems but there

454  
00:19:34,200 --> 00:19:32,200  
are literally thousands of people

455  
00:19:36,870 --> 00:19:34,210  
required to build a rocket or an

456  
00:19:39,360 --> 00:19:36,880  
airplane or or anything today in spite

457  
00:19:40,950 --> 00:19:39,370  
of the fact that technology has really

458  
00:19:43,250 --> 00:19:40,960  
come to the fore and a lot of it is

459  
00:19:47,940 --> 00:19:43,260  
automated but still thousands of people

460  
00:19:49,200 --> 00:19:47,950  
definitely all right let's that we

461  
00:19:53,669 --> 00:19:49,210  
actually have another question from

462  
00:19:57,210 --> 00:19:53,679  
Gmail for Ted if this one is for you it

463  
00:20:00,000 --> 00:19:57,220

seems very difficult to convey detailed

464

00:20:01,830 --> 00:20:00,010

scientific information in a film so how

465

00:20:03,899 --> 00:20:01,840

did you approach that challenge as a

466

00:20:06,450 --> 00:20:03,909

director and what techniques did you use

467

00:20:08,190 --> 00:20:06,460

to communicate communicate the complex

468

00:20:12,419 --> 00:20:08,200

technical nature of the work of these

469

00:20:15,630 --> 00:20:12,429

women to a general audience oh well yeah

470

00:20:17,130 --> 00:20:15,640

it's a very hard question and a very big

471

00:20:20,430 --> 00:20:17,140

challenge for us for making the film

472

00:20:22,310 --> 00:20:20,440

because you know in theory or when you

473

00:20:24,960 --> 00:20:22,320

think about you think math is not very

474

00:20:26,789 --> 00:20:24,970

cinematic per se mean its numbers and

475

00:20:30,659 --> 00:20:26,799

its numbers on the board so our

476

00:20:33,480 --> 00:20:30,669

challenge was to make the math cinematic

477

00:20:36,380 --> 00:20:33,490

and explain the math and the problems

478

00:20:38,630 --> 00:20:36,390

that and NASA was facing together

479

00:20:40,160 --> 00:20:38,640

rocket into space at that time in

480

00:20:43,570 --> 00:20:40,170

layman's terms in terms that everyone

481

00:20:46,250 --> 00:20:43,580

can understand which you know took me

482

00:20:49,190 --> 00:20:46,260

months to actually understand it and

483

00:20:52,040 --> 00:20:49,200

even though bill explained it to me you

484

00:20:54,350 --> 00:20:52,050

know a bunch of times it takes a long

485

00:20:57,710 --> 00:20:54,360

time for it to sink in so we wrote a

486

00:21:00,770 --> 00:20:57,720

scene which you'll see in the movie that

487

00:21:04,400 --> 00:21:00,780

Jim Parsons explains the main problem

488

00:21:07,550 --> 00:21:04,410

that NASA was facing with going from a

489

00:21:10,520 --> 00:21:07,560

suborbital flight to an orbital flight

490

00:21:12,860 --> 00:21:10,530

and that was a huge jump in the space

491

00:21:15,860 --> 00:21:12,870

program to get to that point to go from

492

00:21:17,960 --> 00:21:15,870

sub orbit which essentially if you think

493

00:21:19,430 --> 00:21:17,970

of a sub orbit and and I'm probably

494

00:21:21,980 --> 00:21:19,440

going to butcher this because I'm not a

495

00:21:23,510 --> 00:21:21,990

scientist but a sub orbit you know you

496

00:21:26,510 --> 00:21:23,520

start on the earth and the rocket takes

497

00:21:28,160 --> 00:21:26,520

off goes up into the sub or but not into

498

00:21:30,770 --> 00:21:28,170

the atmosphere somewhere and comes

499

00:21:34,340 --> 00:21:30,780

straight back down so in layman's terms

500

00:21:36,170 --> 00:21:34,350

that math is a triangle and that's

501  
00:21:38,300 --> 00:21:36,180  
something every one of you knows right

502  
00:21:41,120 --> 00:21:38,310  
as a triangle and so those angles and

503  
00:21:46,340 --> 00:21:41,130  
that that math is known with an orbital

504  
00:21:48,890 --> 00:21:46,350  
flight the rocket shoots the capsule out

505  
00:21:50,990 --> 00:21:48,900  
into the orbit past the sub orbit and

506  
00:21:53,390 --> 00:21:51,000  
then they'll you could jump in here from

507  
00:21:55,820 --> 00:21:53,400  
bombing on this one book and and what it

508  
00:21:58,520 --> 00:21:55,830  
does is it it it gets caught in the

509  
00:22:01,280 --> 00:21:58,530  
Earth's atmosphere and it goes around

510  
00:22:03,530 --> 00:22:01,290  
like that in elliptical orbit right

511  
00:22:06,680 --> 00:22:03,540  
so and this elliptical orbit the theory

512  
00:22:09,170 --> 00:22:06,690  
is the capsule will spin around the

513  
00:22:11,570 --> 00:22:09,180

earth forever because there's nothing to

514

00:22:13,310 --> 00:22:11,580

bring it back down and so that was the

515

00:22:16,970 --> 00:22:13,320

main problem that NASA was facing is how

516

00:22:19,070 --> 00:22:16,980

to get this elliptical orbit back into

517

00:22:21,410 --> 00:22:19,080

Earth's atmosphere back onto the ground

518

00:22:23,150 --> 00:22:21,420

safely and so we have a scene in the

519

00:22:25,970 --> 00:22:23,160

movie where Jim Parsons explains that

520

00:22:28,790 --> 00:22:25,980

and uh you know we tried to make it as

521

00:22:29,930 --> 00:22:28,800

cinematic as possible um I hope we did a

522

00:22:34,220 --> 00:22:29,940

good job you'll have to let me know if

523

00:22:35,690 --> 00:22:34,230

we did great thank you

524

00:22:40,580 --> 00:22:35,700

all right let's take another question

525

00:22:42,740 --> 00:22:40,590

from our in-studio audience hi my name

526  
00:22:46,100 --> 00:22:42,750  
is Calvin Harris and my questions for

527  
00:22:48,710 --> 00:22:46,110  
mr. Melfi all right Ted we have another

528  
00:22:49,820 --> 00:22:48,720  
question for you go ahead what technical

529  
00:22:52,990 --> 00:22:49,830  
advisors were in poor

530  
00:22:55,549 --> 00:22:53,000  
and for the development of this movie

531  
00:22:56,960 --> 00:22:55,559  
the question is what technical advisors

532  
00:23:01,639 --> 00:22:56,970  
were important in the development of the

533  
00:23:05,539 --> 00:23:01,649  
movie yeah yes Oh while you're staring

534  
00:23:09,019 --> 00:23:05,549  
at one of them the dr. berry there and

535  
00:23:12,680 --> 00:23:09,029  
dr. Ullrich were tremendously helpful in

536  
00:23:13,789 --> 00:23:12,690  
explaining everything that NASA was

537  
00:23:15,529 --> 00:23:13,799  
going through especially what I just

538  
00:23:18,440 --> 00:23:15,539

talked about it's an elliptical orbit -

539

00:23:20,480 --> 00:23:18,450

a parabolic orbit without them I don't

540

00:23:23,029 --> 00:23:20,490

know if we have a movie we just have a

541

00:23:26,419 --> 00:23:23,039

you know a bunch of Hollywood rigmarole

542

00:23:29,450 --> 00:23:26,429

but they made it real we also had a math

543

00:23:31,310 --> 00:23:29,460

specialist dr. Rudy horn who is a math

544

00:23:34,039 --> 00:23:31,320

specialist out of Morehouse College in

545

00:23:36,409 --> 00:23:34,049

Atlanta who really worked hard on

546

00:23:40,220 --> 00:23:36,419

getting us to understand the actual math

547

00:23:42,350 --> 00:23:40,230

bind so dr. berry explained the science

548

00:23:44,750 --> 00:23:42,360

behind it and the problems behind it and

549

00:23:46,940 --> 00:23:44,760

dr. rudi horne explained the math behind

550

00:23:49,149 --> 00:23:46,950

it which was even more confusing if you

551

00:23:52,669 --> 00:23:49,159

could imagine it's a lot of math but

552

00:23:55,090 --> 00:23:52,679

between the two of them and nasa support

553

00:23:57,529 --> 00:23:55,100

we got a pretty good understanding of

554

00:23:58,820 --> 00:23:57,539

what of what it would take

555

00:24:00,940 --> 00:23:58,830

well what nasa was going through at that

556

00:24:04,960 --> 00:24:00,950

time so those were our main advisors

557

00:24:08,960 --> 00:24:04,970

NASA's NASA's how and dr. Rudi horn

558

00:24:11,769 --> 00:24:08,970

great thank you so uh we have another

559

00:24:14,120 --> 00:24:11,779

question from gmail here and I'm gonna

560

00:24:17,389 --> 00:24:14,130

actually give it a little bit of context

561

00:24:19,370 --> 00:24:17,399

first we call the story is called hidden

562

00:24:23,899 --> 00:24:19,380

figures and of course that refers to

563

00:24:25,519 --> 00:24:23,909

these women who were hidden at NASA who

564

00:24:27,230 --> 00:24:25,529

weren't widely recognized at the time

565

00:24:30,889 --> 00:24:27,240

and this story they were such an

566

00:24:32,750 --> 00:24:30,899

important part of NASA's work but the

567

00:24:35,450 --> 00:24:32,760

story wasn't widely known until more

568

00:24:39,379 --> 00:24:35,460

recently so could you talk a little bit

569

00:24:42,669 --> 00:24:39,389

about how NASA and others have

570

00:24:45,470 --> 00:24:42,679

recognized the work that these women did

571

00:24:49,549 --> 00:24:45,480

since then and why this is a story

572

00:24:52,460 --> 00:24:49,559

now I'll start I guess we actually had

573

00:24:54,379 --> 00:24:52,470

started prior to hidden figures trying

574

00:24:56,029 --> 00:24:54,389

to we didn't know the term hidden

575

00:24:58,610 --> 00:24:56,039

figures but for a number of years now

576

00:25:01,820 --> 00:24:58,620

nASA has really been focusing on women

577

00:25:03,470 --> 00:25:01,830

in aerospace and women at NASA we

578

00:25:05,090 --> 00:25:03,480

actually on our website for

579

00:25:07,460 --> 00:25:05,100

a number of years now have had a feature

580

00:25:10,400 --> 00:25:07,470

that's called women at NASA where we

581

00:25:13,040 --> 00:25:10,410

tried to feature people that most folk

582

00:25:15,440 --> 00:25:13,050

who look at NASA would not think about

583

00:25:18,310 --> 00:25:15,450

when the movie hidden figures came along

584

00:25:21,350 --> 00:25:18,320

in the book it was a perfect match

585

00:25:26,420 --> 00:25:21,360

because it enabled us to then Blanche a

586

00:25:31,430 --> 00:25:26,430

key can you please who just happened to

587

00:25:34,610 --> 00:25:31,440

be women and minority so it was a it was

588

00:25:37,730 --> 00:25:34,620

a perfect for a or a perfect segue for

589

00:25:41,480 --> 00:25:37,740

us to go from the moon into featuring

590

00:25:44,240 --> 00:25:41,490

even even more importantly the women and

591

00:25:48,260 --> 00:25:44,250

minorities who are a critical critical

592

00:25:50,660 --> 00:25:48,270

important part of the agency Becky if

593

00:25:51,860 --> 00:25:50,670

you read Margo's book which is a great

594

00:25:54,500 --> 00:25:51,870

book by the way

595

00:25:57,170 --> 00:25:54,510

hidden figures she actually in the

596

00:25:58,880 --> 00:25:57,180

epilogue at the end mentions that she

597

00:26:01,460 --> 00:25:58,890

really liked the title but it's kind of

598

00:26:03,740 --> 00:26:01,470

a misnomer because they weren't actively

599

00:26:06,440 --> 00:26:03,750

hidden figures so much as they were just

600

00:26:07,700 --> 00:26:06,450

sort of overlooked as as well as a

601  
00:26:09,110 --> 00:26:07,710  
historian I can tell you they're there

602  
00:26:12,790 --> 00:26:09,120  
there were thousands of people work for

603  
00:26:15,470 --> 00:26:12,800  
the NACA and for NASA whose stories are

604  
00:26:19,190 --> 00:26:15,480  
wonderful and and should be told but

605  
00:26:21,320 --> 00:26:19,200  
just haven't come out yet so early in

606  
00:26:22,850 --> 00:26:21,330  
the 90s actually the the historian that

607  
00:26:24,950 --> 00:26:22,860  
was working here at Langley at the time

608  
00:26:27,320 --> 00:26:24,960  
actually did some early interviews with

609  
00:26:29,060 --> 00:26:27,330  
so in 1990 there some taped interviews

610  
00:26:31,250 --> 00:26:29,070  
with women computers who had worked at

611  
00:26:33,410 --> 00:26:31,260  
at Langley and there was some there's

612  
00:26:35,120 --> 00:26:33,420  
some interest in the subject as a

613  
00:26:37,580 --> 00:26:35,130

master's thesis written about the women

614

00:26:39,200 --> 00:26:37,590

computers who worked here and so that's

615

00:26:41,090 --> 00:26:39,210

been a subject that we've collected data

616

00:26:43,010 --> 00:26:41,100

on and hope that someone would tell the

617

00:26:45,770 --> 00:26:43,020

story about and boy did we get lucky

618

00:26:47,920 --> 00:26:45,780

that that a daughter of a former langley

619

00:26:50,000 --> 00:26:47,930

employee you're retired Langley employee

620

00:26:51,890 --> 00:26:50,010

picked this thing up and did such a

621

00:26:53,450 --> 00:26:51,900

great job telling the story that that

622

00:26:55,550 --> 00:26:53,460

it's become a great book and that it

623

00:26:57,800 --> 00:26:55,560

attracted Ted's attention and it's

624

00:26:59,780 --> 00:26:57,810

become a great movie you know that's a

625

00:27:01,190 --> 00:26:59,790

great way to get our story told a number

626  
00:27:02,750 --> 00:27:01,200  
of years ago there was another book an

627  
00:27:05,390 --> 00:27:02,760  
earlier book called they could not fail

628  
00:27:09,110 --> 00:27:05,400  
and it focused on the african-american

629  
00:27:12,920 --> 00:27:09,120  
engineer in the very very early days of

630  
00:27:16,370 --> 00:27:12,930  
NASA guess it was missing

631  
00:27:18,290 --> 00:27:16,380  
women because it did not occur to them

632  
00:27:20,840 --> 00:27:18,300  
that there may have been women engineers

633  
00:27:22,430 --> 00:27:20,850  
and the like and you know the author of

634  
00:27:25,160 --> 00:27:22,440  
the book I've heard her in interviews

635  
00:27:26,810 --> 00:27:25,170  
when she says she kept going back to

636  
00:27:28,970 --> 00:27:26,820  
what bill says about him and Becky about

637  
00:27:30,110 --> 00:27:28,980  
them not really being hidden she said

638  
00:27:31,130 --> 00:27:30,120

she couldn't understand what people were

639

00:27:34,310 --> 00:27:31,140

talking about about there being no

640

00:27:35,630 --> 00:27:34,320

minorities no women at Langley or in

641

00:27:37,850 --> 00:27:35,640

NASA because she went to church with

642

00:27:39,260 --> 00:27:37,860

them you know she went to school with

643

00:27:41,840 --> 00:27:39,270

their kids so it was a matter of

644

00:27:44,750 --> 00:27:41,850

somebody again I'll go back to my need

645

00:27:47,210 --> 00:27:44,760

for communicators we needed someone who

646

00:27:49,430 --> 00:27:47,220

was able to tell the story and bring

647

00:27:52,640 --> 00:27:49,440

them out of the shadows if you will they

648

00:27:55,640 --> 00:27:52,650

were there doing their jobs just nobody

649

00:27:59,000 --> 00:27:55,650

told their story to follow up with that

650

00:28:01,910 --> 00:27:59,010

and another question from from online

651  
00:28:03,620 --> 00:28:01,920  
how did NACA find these women they were

652  
00:28:06,620 --> 00:28:03,630  
you know they were homemakers they were

653  
00:28:09,590 --> 00:28:06,630  
teachers they they didn't live here in

654  
00:28:12,170 --> 00:28:09,600  
this area they traveled so how how did

655  
00:28:14,330 --> 00:28:12,180  
how are they convinced to come and do

656  
00:28:16,490 --> 00:28:14,340  
this work that's a really good question

657  
00:28:18,790 --> 00:28:16,500  
and Margo does a great job in the book

658  
00:28:21,410 --> 00:28:18,800  
of explaining that I think but

659  
00:28:22,790 --> 00:28:21,420  
essentially most of the particular the

660  
00:28:26,030 --> 00:28:22,800  
african-american woman who came during

661  
00:28:29,180 --> 00:28:26,040  
the war part of this is driven by world

662  
00:28:31,460 --> 00:28:29,190  
war ii a long time ago there were huge

663  
00:28:32,500 --> 00:28:31,470

shortages of people most american men

664

00:28:34,640 --> 00:28:32,510

were off fighting the war

665

00:28:36,650 --> 00:28:34,650

there weren't many left here in America

666

00:28:38,870 --> 00:28:36,660

and so more and more the burden of doing

667

00:28:42,620 --> 00:28:38,880

important war work here on the homefront

668

00:28:43,550 --> 00:28:42,630

fell to women and so all companies and

669

00:28:47,480 --> 00:28:43,560

government agencies were out there

670

00:28:51,650 --> 00:28:47,490

looking for women in early in the war in

671

00:28:53,810 --> 00:28:51,660

1941 President Roosevelt issued an

672

00:28:56,060 --> 00:28:53,820

executive order requiring the federal

673

00:28:57,620 --> 00:28:56,070

government to to bring African Americans

674

00:29:00,380 --> 00:28:57,630

into the federal work force working on

675

00:29:02,210 --> 00:29:00,390

the war effort you'd think that wouldn't

676  
00:29:03,470 --> 00:29:02,220  
you would need to have a executive order

677  
00:29:04,790 --> 00:29:03,480  
to tell you to do that because it seems

678  
00:29:06,560 --> 00:29:04,800  
like an obvious solution but in fact

679  
00:29:09,740 --> 00:29:06,570  
that was it that was a difficult thing

680  
00:29:11,540 --> 00:29:09,750  
to do and and and so that that happened

681  
00:29:15,350 --> 00:29:11,550  
and so once that happened that folks at

682  
00:29:18,140 --> 00:29:15,360  
NACA who already hired women computers

683  
00:29:19,850 --> 00:29:18,150  
to start with in the 30s said well can

684  
00:29:21,350 --> 00:29:19,860  
we find you know some more women and

685  
00:29:23,120 --> 00:29:21,360  
they start looking around and they found

686  
00:29:25,160 --> 00:29:23,130  
mostly actually there were mostly high

687  
00:29:26,049 --> 00:29:25,170  
school teachers or grade school teachers

688  
00:29:28,330 --> 00:29:26,059

in fact who were

689

00:29:31,419 --> 00:29:28,340

in the in the segregated black school

690

00:29:33,549 --> 00:29:31,429

systems here in the south and once and

691

00:29:34,930 --> 00:29:33,559

once they get there you know that first

692

00:29:36,639 --> 00:29:34,940

connection made the first five woman

693

00:29:38,950 --> 00:29:36,649

came to work here at Langley in June in

694

00:29:41,200 --> 00:29:38,960

1943 once they got that connection

695

00:29:43,089 --> 00:29:41,210

established that Network grew rapidly

696

00:29:45,279 --> 00:29:43,099

because these were really good jobs that

697

00:29:48,789 --> 00:29:45,289

paid more than twice what a teacher was

698

00:29:50,349 --> 00:29:48,799

paid in the school system and so women

699

00:29:52,450 --> 00:29:50,359

who were qualified for it and had the

700

00:29:54,519 --> 00:29:52,460

skills and the interest in doing that it

701

00:29:55,839 --> 00:29:54,529

wasn't hard to attract them the hard

702

00:29:57,999 --> 00:29:55,849

part was when they got here finding a

703

00:29:59,560 --> 00:29:58,009

place for him to live because Hampton

704

00:30:01,659 --> 00:29:59,570

was growing rapidly during World War two

705

00:30:04,499 --> 00:30:01,669

housing was short and there are other

706

00:30:06,399 --> 00:30:04,509

issues that impinge on things but

707

00:30:14,259 --> 00:30:06,409

attracting them wasn't actually that big

708

00:30:16,779 --> 00:30:14,269

of a problem um sorry we're going to go

709

00:30:18,099 --> 00:30:16,789

to questions from our schools but I'm

710

00:30:20,680 --> 00:30:18,109

going to ask the questions from our

711

00:30:22,299 --> 00:30:20,690

schools apparently we need Katherine

712

00:30:25,419 --> 00:30:22,309

Johnson to come help us out with the

713

00:30:27,159 --> 00:30:25,429

technical side of this today so I've got

714

00:30:29,289 --> 00:30:27,169

the questions here from our schools the

715

00:30:33,599 --> 00:30:29,299

on our deal and so hopefully they are

716

00:30:36,810 --> 00:30:33,609

they're listening in it can hear us but

717

00:30:41,379 --> 00:30:36,820

actually if we can go back to Ted for

718

00:30:43,479 --> 00:30:41,389

another question why so this is from

719

00:30:46,570 --> 00:30:43,489

Newcastle junior senior high school and

720

00:30:49,479 --> 00:30:46,580

the question is why did you choose those

721

00:30:54,899 --> 00:30:49,489

specific women for the movie and how did

722

00:31:00,759 --> 00:30:58,389

you know casting is everything in the

723

00:31:02,259 --> 00:31:00,769

movie everyone as all of you know as you

724

00:31:04,269 --> 00:31:02,269

watch a movie the first thing you see

725

00:31:07,029 --> 00:31:04,279

and the first thing you catch on to are

726

00:31:08,979 --> 00:31:07,039

the actors playing those parts so it's

727

00:31:10,959 --> 00:31:08,989

very critical that you get the casting

728

00:31:14,229 --> 00:31:10,969

right and take your time to do it

729

00:31:16,690 --> 00:31:14,239

I've been a huge fan of taraji piensan

730

00:31:18,599 --> 00:31:16,700

since her first work in the movie called

731

00:31:21,489 --> 00:31:18,609

The Curious Case of Benjamin Button

732

00:31:24,070 --> 00:31:21,499

where she played Brad Pitt's mom and I

733

00:31:26,799 --> 00:31:24,080

just fell in love with her work in that

734

00:31:30,180 --> 00:31:26,809

movie and just she's a phenomenally

735

00:31:32,529 --> 00:31:30,190

powerful actress and and then I know you

736

00:31:35,109 --> 00:31:32,539

some of you probably know her from a

737

00:31:39,460 --> 00:31:35,119

recent television series on Empire which

738

00:31:40,250 --> 00:31:39,470

is night and day I mean not to they

739

00:31:44,600 --> 00:31:40,260

couldn't be

740

00:31:46,910 --> 00:31:44,610

and to think that she can do that body

741

00:31:48,740 --> 00:31:46,920

of work and that range I thought to

742

00:31:50,930 --> 00:31:48,750

myself whether whether what a beautiful

743

00:31:53,420 --> 00:31:50,940

and fresh choice to play the very

744

00:31:56,120 --> 00:31:53,430

elegant and reserved Catherine Johnson

745

00:31:59,450 --> 00:31:56,130

and and they really worked out for us

746

00:32:00,920 --> 00:31:59,460

because taraji is just a powerhouse I

747

00:32:03,410 --> 00:32:00,930

was able to play Catherine with such

748

00:32:05,470 --> 00:32:03,420

poise and such elegance and she really

749

00:32:08,360 --> 00:32:05,480

dug into the math and she was fantastic

750

00:32:10,820 --> 00:32:08,370

Octavia Spencer plays Dorothy Vaughan

751  
00:32:13,160 --> 00:32:10,830  
and Octavia Spencer is to me one of the

752  
00:32:15,290 --> 00:32:13,170  
greatest actors in the world she can do

753  
00:32:16,700 --> 00:32:15,300  
no wrong ever ever since she broke out

754  
00:32:18,790 --> 00:32:16,710  
of the scene with the movie the help

755  
00:32:21,470 --> 00:32:18,800  
which I'm sure a lot of you have seen

756  
00:32:23,930 --> 00:32:21,480  
she's just a fantastic town and a

757  
00:32:27,170 --> 00:32:23,940  
wonderful human being and she represents

758  
00:32:32,140 --> 00:32:27,180  
the maternal character because Dorothy

759  
00:32:35,630 --> 00:32:32,150  
Vaughn at her times at NASA put herself

760  
00:32:37,550 --> 00:32:35,640  
about put others above herself and so

761  
00:32:39,230 --> 00:32:37,560  
was always looking out for her women and

762  
00:32:41,810 --> 00:32:39,240  
getting them helping them get promotions

763  
00:32:43,820 --> 00:32:41,820

and helping them learn and so the Wonder

764

00:32:46,280 --> 00:32:43,830

the maternal person there and Octavia

765

00:32:47,960 --> 00:32:46,290

really has that energy and then I'm sure

766

00:32:50,450 --> 00:32:47,970

some of you know Janelle Monae from her

767

00:32:53,720 --> 00:32:50,460

work in music and Janelle Monae plays

768

00:32:59,780 --> 00:32:53,730

Mary Jackson and Mary Jackson represents

769

00:33:02,540 --> 00:32:59,790

the in my mind the fire of a person not

770

00:33:04,760 --> 00:33:02,550

willing to take no for an answer and

771

00:33:07,010 --> 00:33:04,770

wanting to fight for what was right and

772

00:33:10,160 --> 00:33:07,020

from what she deserved and Janelle Monae

773

00:33:13,100 --> 00:33:10,170

is an activist and a fighter for all

774

00:33:15,950 --> 00:33:13,110

four causes and she really really really

775

00:33:18,890 --> 00:33:15,960

came into the came into the part when

776

00:33:20,510 --> 00:33:18,900

such passion is such vim she just won

777

00:33:22,670 --> 00:33:20,520

this over so she was a great choice for

778

00:33:24,610 --> 00:33:22,680

that and then for NASA's administrator

779

00:33:27,260 --> 00:33:24,620

at the time we went with Kevin Costner

780

00:33:30,410 --> 00:33:27,270

yes and I'm sure most of you know Kevin

781

00:33:32,660 --> 00:33:30,420

Costner Kevin Costner is one of the last

782

00:33:35,300 --> 00:33:32,670

remaining movie stars in my mind he sees

783

00:33:37,340 --> 00:33:35,310

just a one of the most stand-up human

784

00:33:39,440 --> 00:33:37,350

beings I've ever met and we wanted

785

00:33:41,900 --> 00:33:39,450

someone really stoic and strong to play

786

00:33:42,620 --> 00:33:41,910

the NASA Administrator and Kevin was

787

00:33:44,480 --> 00:33:42,630

fantastic

788

00:33:46,640 --> 00:33:44,490

with that as well and then the rest of

789

00:33:50,300 --> 00:33:46,650

the cast is filled out by Jim Parsons

790

00:33:52,940 --> 00:33:50,310

who you most of you know from a show

791

00:33:53,850 --> 00:33:52,950

called Big Bang Theory and he plays a

792

00:33:55,110 --> 00:33:53,860

scientist on the

793

00:33:57,690 --> 00:33:55,120

Big Bang Theory so it's kind of a

794

00:33:59,400 --> 00:33:57,700

perfect perfect transition to play a

795

00:34:03,419 --> 00:33:59,410

scientist for NASA and then kirsten

796

00:34:05,880 --> 00:34:03,429

dunst plays vivian mitchell the the head

797

00:34:07,770 --> 00:34:05,890

of the female computing group and she

798

00:34:09,450 --> 00:34:07,780

does a fantastic job too and these

799

00:34:11,879 --> 00:34:09,460

people playing against type because

800

00:34:14,879 --> 00:34:11,889

there are there are themes in the movie

801  
00:34:17,159 --> 00:34:14,889  
that are tough they will be tough for

802  
00:34:20,300 --> 00:34:17,169  
you to watch because a lot of you are

803  
00:34:22,770 --> 00:34:20,310  
young enough to not understand what

804  
00:34:25,740 --> 00:34:22,780  
racism was at that time and what sexism

805  
00:34:29,369 --> 00:34:25,750  
was at that time but growing up in in

806  
00:34:31,139 --> 00:34:29,379  
the segregated state of Virginia at that

807  
00:34:34,349 --> 00:34:31,149  
time is very very challenging for these

808  
00:34:36,720 --> 00:34:34,359  
women and you guys will not understand

809  
00:34:40,560 --> 00:34:36,730  
that because you don't live in that time

810  
00:34:42,240 --> 00:34:40,570  
thank God so it was really hard for Jim

811  
00:34:44,669 --> 00:34:42,250  
Parsons and really hard for Kirsten does

812  
00:34:47,010 --> 00:34:44,679  
to play characters that are so opposite

813  
00:34:48,540 --> 00:34:47,020

of who they are as human beings and I

814

00:34:50,700 --> 00:34:48,550

really wanted character actors that were

815

00:34:53,520 --> 00:34:50,710

likeable to play roles that were

816

00:34:57,599 --> 00:34:53,530

unlikable though would make it more more

817

00:35:00,750 --> 00:34:57,609

it would make it easier to take all

818

00:35:03,359 --> 00:35:00,760

right thank you all right we are gonna

819

00:35:06,960 --> 00:35:03,369

go to a question from Winthrop

820

00:35:09,210 --> 00:35:06,970

Elementary School and to get back into a

821

00:35:12,960 --> 00:35:09,220

little bit more of the science and math

822

00:35:15,690 --> 00:35:12,970

side of this let's talk about what kind

823

00:35:18,780 --> 00:35:15,700

of math these women were computing to

824

00:35:20,940 --> 00:35:18,790

help these launches so let's talk a

825

00:35:22,770 --> 00:35:20,950

little bit about the the actual numbers

826

00:35:26,280 --> 00:35:22,780

so what kind of math were they doing

827

00:35:28,890 --> 00:35:26,290

well in fact as you'll see in the movie

828

00:35:31,230 --> 00:35:28,900

the thing that really threw them a loop

829

00:35:33,180 --> 00:35:31,240

was they had been doing parabolic

830

00:35:35,220 --> 00:35:33,190

computations which is you know

831

00:35:37,470 --> 00:35:35,230

suborbital spaceflight and they went

832

00:35:39,560 --> 00:35:37,480

into a type of math that that goes to

833

00:35:41,730 --> 00:35:39,570

what's called orbital mechanics

834

00:35:45,359 --> 00:35:41,740

something that not a lot of people do

835

00:35:47,280 --> 00:35:45,369

anything at all about in those days you

836

00:35:51,300 --> 00:35:47,290

know all of a sudden things don't in

837

00:35:53,580 --> 00:35:51,310

fact when you fly in space and orbital

838

00:35:55,920 --> 00:35:53,590

mechanics comes into play you find that

839

00:35:57,810 --> 00:35:55,930

things can work it's not an airplane

840

00:36:00,780 --> 00:35:57,820

flying a spaceship around because it

841

00:36:02,430 --> 00:36:00,790

doesn't behave the way that an airplane

842

00:36:04,440 --> 00:36:02,440

does because your planes are using

843

00:36:06,330 --> 00:36:04,450

geometry and trigonometry and we're

844

00:36:09,060 --> 00:36:06,340

we're subject to the laws of

845

00:36:11,330 --> 00:36:09,070

mechanics so that was the biggest

846

00:36:14,490 --> 00:36:11,340

difference was the fact of going from

847

00:36:16,230 --> 00:36:14,500

where all you had to worry about was

848

00:36:19,350 --> 00:36:16,240

gravity and all of a sudden now you

849

00:36:19,950 --> 00:36:19,360

don't my speed gravity curvature of the

850

00:36:24,270 --> 00:36:19,960

earth

851

00:36:25,890 --> 00:36:24,280

the gravity field is different in

852

00:36:29,010 --> 00:36:25,900

different places as lots of things to be

853

00:36:30,750 --> 00:36:29,020

conservative and ask the mathematician I

854

00:36:33,060 --> 00:36:30,760

was gonna see really tell us a little

855

00:36:35,040 --> 00:36:33,070

bit about what kind of math you do today

856

00:36:37,560 --> 00:36:35,050

in the projects that you're working on

857

00:36:40,680 --> 00:36:37,570

okay that's a good question so we do a

858

00:36:43,440 --> 00:36:40,690

lot of computations and we do a lot of

859

00:36:46,350 --> 00:36:43,450

developing of tools to look at different

860

00:36:49,230 --> 00:36:46,360

systems and so it's a system approach to

861

00:36:51,180 --> 00:36:49,240

see look at a system perturb that system

862

00:36:53,070 --> 00:36:51,190

and so that takes a lot of a lot of

863

00:36:55,460 --> 00:36:53,080

algebra a lot of calculus there's a lot

864

00:36:58,590 --> 00:36:55,470

of unknowns and so we use those type of

865

00:37:00,180 --> 00:36:58,600

mathematical tools to help us design and

866

00:37:03,690 --> 00:37:00,190

do the analysis that we need to figure

867

00:37:08,520 --> 00:37:03,700

out how for instance a robotic mission

868

00:37:11,010 --> 00:37:08,530

might work or how for instance a vehicle

869

00:37:14,190 --> 00:37:11,020

might work on the surface of Mars or how

870

00:37:16,220 --> 00:37:14,200

we might do research resource

871

00:37:19,020 --> 00:37:16,230

utilization and things of that nature so

872

00:37:22,920 --> 00:37:19,030

so what would you say to one of these

873

00:37:25,860 --> 00:37:22,930

students here today who says math a lot

874

00:37:27,780 --> 00:37:25,870

of computer do that for me so so

875

00:37:29,250 --> 00:37:27,790

computers are great right computers are

876

00:37:33,330 --> 00:37:29,260

very very great but if we don't

877

00:37:35,040 --> 00:37:33,340

understand the information that we are

878

00:37:36,720 --> 00:37:35,050

putting into the computers then we never

879

00:37:38,070 --> 00:37:36,730

know what we're getting out of it and so

880

00:37:40,140 --> 00:37:38,080

for instance you can plug plenty of

881

00:37:42,510 --> 00:37:40,150

numbers in hit a couple of plus signs

882

00:37:44,010 --> 00:37:42,520

and if you don't understand what you're

883

00:37:46,260 --> 00:37:44,020

trying to get out of it then it's just a

884

00:37:48,240 --> 00:37:46,270

black box right it's just a box and so

885

00:37:49,890 --> 00:37:48,250

you really do have to have understanding

886

00:37:52,140 --> 00:37:49,900

of the mathematics and so as

887

00:37:54,300 --> 00:37:52,150

administrator bolden said that chicken

888

00:37:55,920 --> 00:37:54,310

domination trigonometry so you have to

889

00:37:58,200 --> 00:37:55,930

know the triangles and the circles and

890

00:37:59,940 --> 00:37:58,210

isosceles triangles the calculus you

891

00:38:01,380 --> 00:37:59,950

have to be able to find X you know you

892

00:38:03,720 --> 00:38:01,390

have all these different variables and

893

00:38:07,020 --> 00:38:03,730

you have to be able to see you guys are

894

00:38:10,020 --> 00:38:07,030

surviving finding access so it is really

895

00:38:12,990 --> 00:38:10,030

really important to understand the math

896

00:38:15,120 --> 00:38:13,000

so that you can do modeling so that you

897

00:38:16,710 --> 00:38:15,130

can do what they call now coding I used

898

00:38:19,350 --> 00:38:16,720

to call it software but it's coding now

899

00:38:19,810 --> 00:38:19,360

and so it is understanding of the math

900

00:38:22,000 --> 00:38:19,820

and so and

901  
00:38:24,070 --> 00:38:22,010  
really truly important to understand

902  
00:38:26,470 --> 00:38:24,080  
that math and it's also very important

903  
00:38:28,480 --> 00:38:26,480  
to understand the science behind it so

904  
00:38:30,370 --> 00:38:28,490  
as a physicist you have to understand

905  
00:38:32,620 --> 00:38:30,380  
things like gravity and you have to

906  
00:38:35,080 --> 00:38:32,630  
understand the laws of science to help

907  
00:38:36,070 --> 00:38:35,090  
you to help you understand exactly what

908  
00:38:38,800 --> 00:38:36,080  
you're trying to get out of that

909  
00:38:41,890 --> 00:38:38,810  
solution I'll get one thing you cannot

910  
00:38:44,710 --> 00:38:41,900  
go forward unless you understand the

911  
00:38:47,200 --> 00:38:44,720  
basics you've got to understand addition

912  
00:38:49,420 --> 00:38:47,210  
subtraction multiplication and division

913  
00:38:51,520 --> 00:38:49,430

calculus is something that drives some

914

00:38:53,650 --> 00:38:51,530

of you crazy if you're taking it and it

915

00:38:55,240 --> 00:38:53,660

did the same for me until I had a

916

00:38:56,920 --> 00:38:55,250

professor one time who said look all

917

00:38:59,860 --> 00:38:56,930

you're doing is adding it's just

918

00:39:02,770 --> 00:38:59,870

infinite addition your calculus is is a

919

00:39:05,680 --> 00:39:02,780

mathematics that allows you to take

920

00:39:08,770 --> 00:39:05,690

infinite slices of something and come up

921

00:39:12,310 --> 00:39:08,780

to solve a plain old problem of addition

922

00:39:15,160 --> 00:39:12,320

so you got to understand the basics as

923

00:39:17,800 --> 00:39:15,170

Julie was saying you can think in your

924

00:39:19,300 --> 00:39:17,810

brain and use critical thinking to say

925

00:39:21,580 --> 00:39:19,310

okay does this answer that the computer

926

00:39:23,050 --> 00:39:21,590

just gave me make sense if you don't

927

00:39:24,430 --> 00:39:23,060

understand the basic if you don't

928

00:39:25,930 --> 00:39:24,440

understand what you're trying to do and

929

00:39:28,030 --> 00:39:25,940

what you're looking for the computer

930

00:39:29,950 --> 00:39:28,040

will give you anything and and and

931

00:39:33,730 --> 00:39:29,960

you'll buy it so you don't want to do

932

00:39:36,010 --> 00:39:33,740

that so we have a question here from

933

00:39:38,320 --> 00:39:36,020

Avon intermediate west some of our

934

00:39:40,330 --> 00:39:38,330

students on the DLN and we've been

935

00:39:42,790 --> 00:39:40,340

talking about math and how we used math

936

00:39:46,210 --> 00:39:42,800

up orbital mechanics to calculate

937

00:39:48,100 --> 00:39:46,220

trajectories I imagine that might be

938

00:39:52,090 --> 00:39:48,110

useful for future space exploration

939

00:39:54,340 --> 00:39:52,100

missions as well so what what's the

940

00:39:57,520 --> 00:39:54,350

difference in the actual math of going

941

00:40:00,880 --> 00:39:57,530

to the moon going to Mars going going

942

00:40:03,850 --> 00:40:00,890

further going out there I can take a

943

00:40:05,290 --> 00:40:03,860

shot at that so we do have in the branch

944

00:40:07,840 --> 00:40:05,300

that I work in we do have a group of

945

00:40:10,060 --> 00:40:07,850

folks who have expertise in trajectory

946

00:40:11,620 --> 00:40:10,070

analysis and it is really really

947

00:40:13,330 --> 00:40:11,630

important that when we are trying to go

948

00:40:15,970 --> 00:40:13,340

to Mars when we need to go there as

949

00:40:18,430 --> 00:40:15,980

efficiently as we possibly can because

950

00:40:19,630 --> 00:40:18,440

when you think about going to Mars right

951  
00:40:21,910 --> 00:40:19,640  
there's nothing there so you have to

952  
00:40:24,490 --> 00:40:21,920  
bring everything with you and so there's

953  
00:40:27,310 --> 00:40:24,500  
a there's a constraint on how much you

954  
00:40:29,950 --> 00:40:27,320  
can actually lift off the surface of the

955  
00:40:31,990 --> 00:40:29,960  
planet and get into space and so what

956  
00:40:33,550 --> 00:40:32,000  
you want to do is be able to optimize

957  
00:40:36,850 --> 00:40:33,560  
all of those different two

958  
00:40:38,770 --> 00:40:36,860  
Jeffery's all those all of that going

959  
00:40:40,750 --> 00:40:38,780  
around the going around the earth and

960  
00:40:42,820 --> 00:40:40,760  
using that trajectory to help you get to

961  
00:40:44,560 --> 00:40:42,830  
Mars because it's not a straight shot to

962  
00:40:47,020 --> 00:40:44,570  
Mars it's not like getting on 95 and

963  
00:40:49,870 --> 00:40:47,030

going from Earth to Mars is it's a much

964

00:40:51,490 --> 00:40:49,880

different process is a much different

965

00:40:54,220 --> 00:40:51,500

way to go and you have to understand

966

00:40:56,380 --> 00:40:54,230

again that whole orbital trajectory and

967

00:40:57,760 --> 00:40:56,390

orbital mechanics and there are people

968

00:40:59,320 --> 00:40:57,770

like I said in my brands that do that

969

00:41:01,240 --> 00:40:59,330

and they use computers and they're

970

00:41:03,550 --> 00:41:01,250

experts and so when I think about the

971

00:41:05,890 --> 00:41:03,560

movie hidden figures and I think about

972

00:41:07,300 --> 00:41:05,900

Miss Johnson and those folks who were

973

00:41:09,520 --> 00:41:07,310

doing those calculations she could

974

00:41:11,230 --> 00:41:09,530

actually see that all in her head and

975

00:41:12,910 --> 00:41:11,240

she could even not only see it in her

976  
00:41:14,020 --> 00:41:12,920  
head but she could explain it and when

977  
00:41:16,510 --> 00:41:14,030  
you see the movie you can see her

978  
00:41:18,130 --> 00:41:16,520  
writing these things out and so yes it's

979  
00:41:21,010 --> 00:41:18,140  
all very very important and same

980  
00:41:23,440 --> 00:41:21,020  
application same things that you know we

981  
00:41:26,140 --> 00:41:23,450  
need to do to go to Mars as a matter of

982  
00:41:27,640 --> 00:41:26,150  
fact I read Margo's book and it was an

983  
00:41:29,740 --> 00:41:27,650  
awesome book and at the end of the book

984  
00:41:32,020 --> 00:41:29,750  
when the astronauts had successfully

985  
00:41:33,400 --> 00:41:32,030  
landed on the moon Kathryn and the folks

986  
00:41:35,200 --> 00:41:33,410  
that she was working with were actually

987  
00:41:37,210 --> 00:41:35,210  
thinking about sending humans to other

988  
00:41:38,770 --> 00:41:37,220

planets so I think that is really so

989

00:41:40,230 --> 00:41:38,780

cool she was thinking about that so many

990

00:41:43,360 --> 00:41:40,240

years ago

991

00:41:45,970 --> 00:41:43,370

so a question from our friends at

992

00:41:47,980 --> 00:41:45,980

Mountain elementary school in Los Alamos

993

00:41:50,740 --> 00:41:47,990

and they want to know how many people

994

00:41:53,230 --> 00:41:50,750

were human computers how many people did

995

00:41:54,970 --> 00:41:53,240

we have doing these calculations well

996

00:41:56,470 --> 00:41:54,980

that's a really interesting question and

997

00:41:57,820 --> 00:41:56,480

I'm glad they asked it because we don't

998

00:42:01,330 --> 00:41:57,830

really have a really good answer to that

999

00:42:04,060 --> 00:42:01,340

question I'm afraid we do know that the

1000

00:42:06,370 --> 00:42:04,070

first woman computers were hired by the

1001  
00:42:08,290 --> 00:42:06,380  
NACA in 1935 there were five of them and

1002  
00:42:09,790 --> 00:42:08,300  
interesting enough in 1943 when I hired

1003  
00:42:12,760 --> 00:42:09,800  
the first african-american computers

1004  
00:42:15,040 --> 00:42:12,770  
they also hired five but the computers

1005  
00:42:17,320 --> 00:42:15,050  
worked at that point they normally

1006  
00:42:19,150 --> 00:42:17,330  
started working in a pool so there'd be

1007  
00:42:21,400 --> 00:42:19,160  
a group of computers and engineers would

1008  
00:42:23,260 --> 00:42:21,410  
bring them things that they needed you

1009  
00:42:25,180 --> 00:42:23,270  
know resolve from the results from

1010  
00:42:26,650 --> 00:42:25,190  
Windtunnel tests and they'd do the

1011  
00:42:31,000 --> 00:42:26,660  
calculations for those things and send

1012  
00:42:32,830 --> 00:42:31,010  
them back but typically a computer would

1013  
00:42:34,870 --> 00:42:32,840

work in the pool for a while and then at

1014

00:42:36,460 --> 00:42:34,880

some point if they get really good or an

1015

00:42:37,960 --> 00:42:36,470

engineer happens to like working with

1016

00:42:39,730 --> 00:42:37,970

such a person a particular skill that

1017

00:42:41,050 --> 00:42:39,740

some certain sort of thing they would

1018

00:42:42,730 --> 00:42:41,060

get pulled out of the pool and sent off

1019

00:42:46,860 --> 00:42:42,740

to work in a laboratory someplace or

1020

00:42:49,350 --> 00:42:46,870

things and eventually NASA after

1021

00:42:50,430 --> 00:42:49,360

after that that period in the 60s NASA

1022

00:42:52,230 --> 00:42:50,440

eventually did away with the pool

1023

00:42:54,410 --> 00:42:52,240

concept at all and sort of hired one

1024

00:42:56,340 --> 00:42:54,420

directly into those positions and

1025

00:42:59,520 --> 00:42:56,350

unfortunately the personnel records from

1026

00:43:01,310 --> 00:42:59,530

those days aren't very complete in

1027

00:43:03,270 --> 00:43:01,320

Margo's book she talks about how many

1028

00:43:05,370 --> 00:43:03,280

african-american woman computers and she

1029

00:43:07,560 --> 00:43:05,380

thinks she's identified about 50 of them

1030

00:43:10,140 --> 00:43:07,570

from her research and she's done a lot

1031

00:43:11,970 --> 00:43:10,150

of research but she says there may be as

1032

00:43:13,170 --> 00:43:11,980

many as 20 more that she hasn't been

1033

00:43:17,670 --> 00:43:13,180

able to identify in terms of the

1034

00:43:19,230 --> 00:43:17,680

african-american Peters the the alt of

1035

00:43:22,050 --> 00:43:19,240

all the computers that worked on neo

1036

00:43:23,910 --> 00:43:22,060

calculations for the NACA in NASA they

1037

00:43:25,620 --> 00:43:23,920

were probably on the order of thousands

1038

00:43:27,110 --> 00:43:25,630

of you know thousand a couple thousand

1039

00:43:29,640 --> 00:43:27,120

maybe that kind of came in and went out

1040

00:43:32,940 --> 00:43:29,650

interesting enough most woman computers

1041

00:43:36,060 --> 00:43:32,950

who worked at at NASA when they got a

1042

00:43:37,800 --> 00:43:36,070

job here they stayed and so some people

1043

00:43:38,940 --> 00:43:37,810

came in and went out and that's that as

1044

00:43:41,550 --> 00:43:38,950

of the confusion because you'd have

1045

00:43:44,070 --> 00:43:41,560

women who would leave to get married and

1046

00:43:45,450 --> 00:43:44,080

then decided they liked the job and NASA

1047

00:43:47,160 --> 00:43:45,460

was happy to hire the back because they

1048

00:43:48,720 --> 00:43:47,170

were skilled and good at their job and

1049

00:43:51,060 --> 00:43:48,730

so we brought it back and when they had

1050

00:43:53,400 --> 00:43:51,070

babies frequently women in the workforce

1051  
00:43:55,800 --> 00:43:53,410  
in the 40s and 50s if you had a baby you

1052  
00:43:57,870 --> 00:43:55,810  
were fired that was that was just that

1053  
00:43:59,370 --> 00:43:57,880  
was not that was not considered

1054  
00:44:00,870 --> 00:43:59,380  
discrimination that time in fact that

1055  
00:44:04,770 --> 00:44:00,880  
rule wasn't changed until the late 60s

1056  
00:44:06,720 --> 00:44:04,780  
long after the movie was over so a woman

1057  
00:44:08,700 --> 00:44:06,730  
would would oftentimes lose their job if

1058  
00:44:10,380 --> 00:44:08,710  
they became pregnant well that didn't

1059  
00:44:12,260 --> 00:44:10,390  
happen at NASA because these women were

1060  
00:44:14,700 --> 00:44:12,270  
so skilled and in demand

1061  
00:44:16,110 --> 00:44:14,710  
heywhat they would cover the work that

1062  
00:44:18,150 --> 00:44:16,120  
takes some time off to have a baby and

1063  
00:44:20,880 --> 00:44:18,160

come back to work and it was daycare on

1064

00:44:23,160 --> 00:44:20,890

site and and off they went so it's an

1065

00:44:24,720 --> 00:44:23,170

interest it's very hard to nail down how

1066

00:44:27,510 --> 00:44:24,730

many people actually worked here because

1067

00:44:30,330 --> 00:44:27,520

they came and went and our records

1068

00:44:31,770 --> 00:44:30,340

aren't aren't that great and Margo who's

1069

00:44:34,530 --> 00:44:31,780

a great researcher hasn't even come up

1070

00:44:35,610 --> 00:44:34,540

with a good answer yet so so I hesitate

1071

00:44:40,590 --> 00:44:35,620

to even think about coming up with

1072

00:44:42,150 --> 00:44:40,600

answer myself all right we have a

1073

00:44:45,330 --> 00:44:42,160

question here from Carver Middle School

1074

00:44:48,150 --> 00:44:45,340

in Tulsa Oklahoma and it's kind of a

1075

00:44:51,240 --> 00:44:48,160

follow-on to that in the obviously these

1076  
00:44:53,700 --> 00:44:51,250  
women were treated somewhat differently

1077  
00:44:54,900 --> 00:44:53,710  
because of who they were because of the

1078  
00:44:59,790 --> 00:44:54,910  
color their skin and the fact that they

1079  
00:45:00,640 --> 00:44:59,800  
were women so that we like to think that

1080  
00:45:02,529 --> 00:45:00,650  
we've moved

1081  
00:45:04,779 --> 00:45:02,539  
past that a lot and we treat people

1082  
00:45:08,019 --> 00:45:04,789  
based on how smart they are and what

1083  
00:45:10,029 --> 00:45:08,029  
their skills are but for anyone on our

1084  
00:45:12,940 --> 00:45:10,039  
panel here do you have advice for these

1085  
00:45:15,279 --> 00:45:12,950  
students on how to deal with people that

1086  
00:45:16,890 --> 00:45:15,289  
may not treat you that way that may

1087  
00:45:19,930 --> 00:45:16,900  
dismiss you based on the way you look

1088  
00:45:21,960 --> 00:45:19,940

instead of treating on dealing with you

1089

00:45:24,789 --> 00:45:21,970

on how based on how smart you are how

1090

00:45:28,510 --> 00:45:24,799

defer to Julie first thing I have a

1091

00:45:29,950 --> 00:45:28,520

philosophy that I preach to to women and

1092

00:45:34,150 --> 00:45:29,960

minorities and I'll offer that after

1093

00:45:35,289 --> 00:45:34,160

julie has a chance to say so when you

1094

00:45:37,089 --> 00:45:35,299

deal with people you have to recognize

1095

00:45:39,609 --> 00:45:37,099

everybody has their own their own

1096

00:45:41,470 --> 00:45:39,619

perspective and so you have to be

1097

00:45:44,950 --> 00:45:41,480

confident in yourself and who you are

1098

00:45:46,359 --> 00:45:44,960

again you get to working at NASA and you

1099

00:45:49,420 --> 00:45:46,369

get to working at different industry

1100

00:45:51,130 --> 00:45:49,430

because you bring a skill to that area

1101  
00:45:53,109 --> 00:45:51,140  
and so you have to be confident in who

1102  
00:45:55,120 --> 00:45:53,119  
you are the background that you have

1103  
00:45:57,039 --> 00:45:55,130  
think about those people who have

1104  
00:45:59,890 --> 00:45:57,049  
encouraged you your parents your

1105  
00:46:02,500 --> 00:45:59,900  
teachers and be able to use that as as

1106  
00:46:04,299 --> 00:46:02,510  
as confidence that you can move on and

1107  
00:46:06,760 --> 00:46:04,309  
do the things that that you need to do

1108  
00:46:09,160 --> 00:46:06,770  
and I'm a little more blunt particularly

1109  
00:46:11,109 --> 00:46:09,170  
for women don't waste your time trying

1110  
00:46:14,260 --> 00:46:11,119  
to explain to somebody why you're in the

1111  
00:46:16,539 --> 00:46:14,270  
room or in the in the laboratory you are

1112  
00:46:19,150 --> 00:46:16,549  
not going to change someone's mind by

1113  
00:46:21,730 --> 00:46:19,160

trying to talk them out of a bias or out

1114

00:46:24,730 --> 00:46:21,740

of being discriminatory what convinces

1115

00:46:27,339 --> 00:46:24,740

them is your performance so really study

1116

00:46:30,069 --> 00:46:27,349

hard become the best that you can be in

1117

00:46:31,510 --> 00:46:30,079

your field and then go do your work and

1118

00:46:34,299 --> 00:46:31,520

do it incredibly well so that people

1119

00:46:36,940 --> 00:46:34,309

recognize you is the best I don't want

1120

00:46:39,609 --> 00:46:36,950

to be a spoiler here but again a

1121

00:46:43,539 --> 00:46:39,619

critical lesson in the movie is watch

1122

00:46:46,539 --> 00:46:43,549

Catherine Johnson and watch the women as

1123

00:46:48,490 --> 00:46:46,549

they adjust to the circumstances where

1124

00:46:50,500 --> 00:46:48,500

people do not want to accept them and

1125

00:46:53,710 --> 00:46:50,510

and they don't do a lot of talking they

1126  
00:46:56,109 --> 00:46:53,720  
just act and and they perform and that's

1127  
00:46:57,460 --> 00:46:56,119  
that's my advice to you don't wait don't

1128  
00:46:59,980 --> 00:46:57,470  
waste your time trying to convince

1129  
00:47:02,470 --> 00:46:59,990  
somebody that you belong and I also

1130  
00:47:04,750 --> 00:47:02,480  
think administrator bolden that it was

1131  
00:47:07,660 --> 00:47:04,760  
because of people like Catherine Johnson

1132  
00:47:10,120 --> 00:47:07,670  
and Dorothy and Mary Jackson who came to

1133  
00:47:12,190 --> 00:47:10,130  
NASA and we're technically excellent

1134  
00:47:13,510 --> 00:47:12,200  
they were technically excellent and

1135  
00:47:15,220 --> 00:47:13,520  
because of them

1136  
00:47:18,310 --> 00:47:15,230  
and the excellence that they brought to

1137  
00:47:20,080 --> 00:47:18,320  
the job and to the challenges that they

1138  
00:47:22,870 --> 00:47:20,090

had they opened the doors for people

1139

00:47:24,490 --> 00:47:22,880

like myself and I and I feel like I am

1140

00:47:26,050 --> 00:47:24,500

standing on their shoulders because if

1141

00:47:27,940 --> 00:47:26,060

they hadn't brought that excellence

1142

00:47:29,920 --> 00:47:27,950

if they hadn't brought that perfection

1143

00:47:31,960 --> 00:47:29,930

if they hadn't brought those skills and

1144

00:47:34,510 --> 00:47:31,970

people understood that they that they

1145

00:47:36,250 --> 00:47:34,520

are that they are an advocate and they

1146

00:47:38,200 --> 00:47:36,260

are helping the team get to the

1147

00:47:40,390 --> 00:47:38,210

solutions that they need and so those

1148

00:47:42,490 --> 00:47:40,400

those women and I you know I applaud

1149

00:47:45,550 --> 00:47:42,500

them and I'm so thankful for the things

1150

00:47:47,050 --> 00:47:45,560

that they do because you know we deal

1151

00:47:48,370 --> 00:47:47,060

with biases now but the things that

1152

00:47:51,550 --> 00:47:48,380

those women dealt with at that time

1153

00:47:53,470 --> 00:47:51,560

we're much more overt and they were much

1154

00:47:55,180 --> 00:47:53,480

more challenging but they were able to

1155

00:47:57,430 --> 00:47:55,190

bring that technical excellence they

1156

00:47:59,350 --> 00:47:57,440

were able to you know send a human to

1157

00:48:01,090 --> 00:47:59,360

the moon and because of those things the

1158

00:48:03,550 --> 00:48:01,100

doors are wide open for people like

1159

00:48:10,960 --> 00:48:03,560

myself administrator bullit and all of

1160

00:48:12,340 --> 00:48:10,970

you guys living on that - Dorothy plays

1161

00:48:14,550 --> 00:48:12,350

a really critical role in all this

1162

00:48:17,470 --> 00:48:14,560

confused the personal supervisor of the

1163

00:48:19,660 --> 00:48:17,480

woman the african-american woman who

1164

00:48:20,710 --> 00:48:19,670

worked in the West competing in it was

1165

00:48:22,270 --> 00:48:20,720

she wasn't the first provides but she

1166

00:48:23,710 --> 00:48:22,280

was the first african-american who

1167

00:48:25,690 --> 00:48:23,720

supervises that unit there was a white

1168

00:48:27,910 --> 00:48:25,700

supervisor that before and when that

1169

00:48:28,990 --> 00:48:27,920

woman became sick Dorothy was stuck in a

1170

00:48:30,910 --> 00:48:29,000

job at being the supervisor without

1171

00:48:32,140 --> 00:48:30,920

being promoted to the job and then she

1172

00:48:36,070 --> 00:48:32,150

was eventually eventually they

1173

00:48:38,530 --> 00:48:36,080

recognized her but what strikes me about

1174

00:48:41,620 --> 00:48:38,540

Dorothy that's so compelling about her

1175

00:48:43,570 --> 00:48:41,630

story is that that she was constantly

1176

00:48:46,210 --> 00:48:43,580

sacrificing her own interest for the

1177

00:48:47,260 --> 00:48:46,220

woman who worked for her and and I mean

1178

00:48:49,420 --> 00:48:47,270

the woman it didn't work for it

1179

00:48:51,820 --> 00:48:49,430

she went to bat as a supervisor she

1180

00:48:53,950 --> 00:48:51,830

could do this at some considerable risk

1181

00:48:55,420 --> 00:48:53,960

to her own future career by the way but

1182

00:48:56,740 --> 00:48:55,430

she could go to bat for other woman so

1183

00:48:58,720 --> 00:48:56,750

she actually went to bat for both

1184

00:49:01,630 --> 00:48:58,730

African American computers and white

1185

00:49:04,090 --> 00:49:01,640

woman computers who were not getting pay

1186

00:49:07,000 --> 00:49:04,100

raises they were supposed to get and and

1187

00:49:08,830 --> 00:49:07,010

in her willingness to sacrifice emotions

1188

00:49:10,090 --> 00:49:08,840

for herself and key jobs that she could

1189

00:49:13,510 --> 00:49:10,100

have taken for herself because of her

1190

00:49:15,520 --> 00:49:13,520

position but instead she did what she

1191

00:49:16,990 --> 00:49:15,530

could for everybody else and and did

1192

00:49:18,970 --> 00:49:17,000

build that foundation that we're all

1193

00:49:20,620 --> 00:49:18,980

standing on now you know because nasa's

1194

00:49:23,230 --> 00:49:20,630

got a much more diverse and effective

1195

00:49:24,760 --> 00:49:23,240

workforce because people like that you

1196

00:49:27,400 --> 00:49:24,770

know did the hard things and made in

1197

00:49:30,180 --> 00:49:27,410

tough decisions and did what was right

1198

00:49:33,700 --> 00:49:30,190

a Ted would you like to add something to

1199

00:49:35,200 --> 00:49:33,710

this discussion yeah yeah I had the

1200

00:49:37,990 --> 00:49:35,210

great pleasure of interviewing Katherine

1201  
00:49:41,230 --> 00:49:38,000  
Johnson twice to as research for the

1202  
00:49:43,630 --> 00:49:41,240  
movie she is 98 years old and at the

1203  
00:49:46,839 --> 00:49:43,640  
time I said Katherine what was it like

1204  
00:49:48,579 --> 00:49:46,849  
to experience racism in the workplace

1205  
00:49:50,349 --> 00:49:48,589  
how was it for you what was it like to

1206  
00:49:53,170 --> 00:49:50,359  
experience sexism in the workplace and

1207  
00:49:55,870 --> 00:49:53,180  
that was it for you and she paused and

1208  
00:49:58,509 --> 00:49:55,880  
she looked at me very very strangely and

1209  
00:50:01,450 --> 00:49:58,519  
said oh I didn't I didn't see any of

1210  
00:50:03,220 --> 00:50:01,460  
that I I just did my work and I put my

1211  
00:50:05,559 --> 00:50:03,230  
head down and I and I did my work and

1212  
00:50:08,890 --> 00:50:05,569  
everyone was so nice to me and so the

1213  
00:50:10,329 --> 00:50:08,900

lesson I think really is the character

1214

00:50:13,990 --> 00:50:10,339

of Katherine Johnson and the lesson for

1215

00:50:17,230 --> 00:50:14,000

you guys do your work do your work

1216

00:50:19,779 --> 00:50:17,240

dig in find your dream reach for it and

1217

00:50:21,759 --> 00:50:19,789

do the work and don't look left or right

1218

00:50:22,870 --> 00:50:21,769

and go straight through and that's what

1219

00:50:26,140 --> 00:50:22,880

NASA did and that's what Katherine

1220

00:50:27,700 --> 00:50:26,150

Johnson did great that is excellent

1221

00:50:29,650 --> 00:50:27,710

advice thank you

1222

00:50:31,690 --> 00:50:29,660

all right we're going to go back to our

1223

00:50:37,359 --> 00:50:31,700

studio audience here for another

1224

00:50:39,450 --> 00:50:37,369

question hello my name is Ania own

1225

00:50:42,190 --> 00:50:39,460

Clayton my questions for Charles Bolden

1226  
00:50:45,099 --> 00:50:42,200  
how did these three ladies cause change

1227  
00:50:47,470 --> 00:50:45,109  
the NASA that's prevalent today and I

1228  
00:50:49,960 --> 00:50:47,480  
think one of the things they did is

1229  
00:50:52,319 --> 00:50:49,970  
Julie has mentioned and and Ted even

1230  
00:50:55,359 --> 00:50:52,329  
talked about it was they performed they

1231  
00:50:57,190 --> 00:50:55,369  
they they essentially put their heads

1232  
00:51:00,940 --> 00:50:57,200  
down and did what they were asked to do

1233  
00:51:03,339 --> 00:51:00,950  
they set goals as you will see and they

1234  
00:51:04,870 --> 00:51:03,349  
went after those goals without paying

1235  
00:51:07,509 --> 00:51:04,880  
any attention to people who said it

1236  
00:51:09,730 --> 00:51:07,519  
could not be done and I think they

1237  
00:51:12,009 --> 00:51:09,740  
provide a model a role model or role

1238  
00:51:13,920 --> 00:51:12,019

models for all of us I joined Julianne

1239

00:51:16,720 --> 00:51:13,930

saying we all stand on their shoulders

1240

00:51:19,450 --> 00:51:16,730

we're just trying to do what we saw them

1241

00:51:21,190 --> 00:51:19,460

do and you know when you when you look

1242

00:51:23,019 --> 00:51:21,200

at Katherine's story as an example

1243

00:51:24,670 --> 00:51:23,029

Katherine I doubt if she ever dreamed

1244

00:51:26,950 --> 00:51:24,680

that she was going to do anything that

1245

00:51:29,200 --> 00:51:26,960

she did she came her father brought her

1246

00:51:33,309 --> 00:51:29,210

here from White Sulphur Springs West

1247

00:51:35,370 --> 00:51:33,319

Virginia or not here but but to where

1248

00:51:37,650 --> 00:51:35,380

West Virginia State University is now

1249

00:51:40,930 --> 00:51:37,660

because he wanted to put his son in

1250

00:51:43,120 --> 00:51:40,940

college and it was while Katherine was

1251

00:51:45,670 --> 00:51:43,130

going to school with her brother her

1252

00:51:47,050 --> 00:51:45,680

older brother she had an opportunity to

1253

00:51:50,650 --> 00:51:47,060

do some things in the classroom and the

1254

00:51:53,260 --> 00:51:50,660

teacher said wow you know you need to be

1255

00:51:54,640 --> 00:51:53,270

here she was 14 years old and and the

1256

00:51:56,530 --> 00:51:54,650

teacher talked to her father and

1257

00:51:59,500 --> 00:51:56,540

convinced them to put her in college she

1258

00:52:02,410 --> 00:51:59,510

graduated at the age of 18 and and then

1259

00:52:04,180 --> 00:52:02,420

came to Langley looking for a job I you

1260

00:52:07,270 --> 00:52:04,190

know like bill says there was there was

1261

00:52:09,069 --> 00:52:07,280

no shortage for NACA and NASA to pick

1262

00:52:11,770 --> 00:52:09,079

from because there were women of color

1263

00:52:13,660 --> 00:52:11,780

who wanted to work and Katherine was one

1264

00:52:15,970 --> 00:52:13,670

of those and she saw an opening and she

1265

00:52:18,280 --> 00:52:15,980

she went after it so I think the three

1266

00:52:20,380 --> 00:52:18,290

of them and and all the women you'll see

1267

00:52:23,620 --> 00:52:20,390

in the movie they just provide

1268

00:52:25,660 --> 00:52:23,630

incredible role models for us in the way

1269

00:52:27,790 --> 00:52:25,670

that they just bore through all of the

1270

00:52:29,950 --> 00:52:27,800

resistance and all the bias and the

1271

00:52:31,300 --> 00:52:29,960

discrimination and I will echo what what

1272

00:52:34,150 --> 00:52:31,310

Katherine said when you're doing your

1273

00:52:35,440 --> 00:52:34,160

work and you're having fun there's a lot

1274

00:52:37,750 --> 00:52:35,450

of stuff going on around you you don't

1275

00:52:39,910 --> 00:52:37,760

notice people ask you about you go I

1276

00:52:42,010 --> 00:52:39,920

didn't notice that and I really didn't

1277

00:52:44,640 --> 00:52:42,020

because I was just doing what I love

1278

00:52:48,190 --> 00:52:44,650

doing and I was having fun

1279

00:52:50,109 --> 00:52:48,200

sorry Nia to another question from Gmail

1280

00:52:52,960 --> 00:52:50,119

from online and to talk a little bit

1281

00:52:54,550 --> 00:52:52,970

about how the women were trained did

1282

00:52:56,740 --> 00:52:54,560

they they came in a lot of them were

1283

00:52:58,690 --> 00:52:56,750

teachers they had some background what

1284

00:53:01,960 --> 00:52:58,700

kind of training did they get when they

1285

00:53:03,370 --> 00:53:01,970

actually got here well Becky most of

1286

00:53:05,859 --> 00:53:03,380

that was on-the-job training

1287

00:53:06,880 --> 00:53:05,869

so they'd arrive particularly in the

1288

00:53:08,829 --> 00:53:06,890

case of the African miracle woman they

1289

00:53:11,920 --> 00:53:08,839

all had degrees in math and they've been

1290

00:53:13,660 --> 00:53:11,930

math teachers largely in schools so they

1291

00:53:16,510 --> 00:53:13,670

came in they're well versed in sort of

1292

00:53:18,069 --> 00:53:16,520

the basics of what needed to be done and

1293

00:53:18,970 --> 00:53:18,079

there were training programs when they

1294

00:53:20,770 --> 00:53:18,980

came into the pool

1295

00:53:22,300 --> 00:53:20,780

Dorothy Vaughn for example was the head

1296

00:53:24,760 --> 00:53:22,310

of the West computing unit would have

1297

00:53:26,290 --> 00:53:24,770

helped those women to understand you

1298

00:53:29,290 --> 00:53:26,300

know what kind of calculations they

1299

00:53:31,089 --> 00:53:29,300

needed to be you need to be doing women

1300

00:53:32,620 --> 00:53:31,099

who had particular skills in certain

1301  
00:53:33,880 --> 00:53:32,630  
kinds of things would be directed to

1302  
00:53:35,680 --> 00:53:33,890  
that work and a woman who didn't have

1303  
00:53:37,240 --> 00:53:35,690  
those skills would often be teamed up

1304  
00:53:41,079 --> 00:53:37,250  
with somebody to learn how to how to do

1305  
00:53:42,400 --> 00:53:41,089  
that and her most of the work was pretty

1306  
00:53:43,870 --> 00:53:42,410  
straightforward I mean that's part of

1307  
00:53:45,579 --> 00:53:43,880  
the reason why they hired women to do

1308  
00:53:47,339 --> 00:53:45,589  
these jobs because the engineers didn't

1309  
00:53:49,690 --> 00:53:47,349  
want to have to do the work right in

1310  
00:53:51,849 --> 00:53:49,700  
1935 when it did the first experiment

1311  
00:53:53,079 --> 00:53:51,859  
with women computers that started

1312  
00:53:54,880 --> 00:53:53,089  
largely because the engineers were

1313  
00:53:57,759 --> 00:53:54,890

complaining about all the time they were

1314

00:53:58,900 --> 00:53:57,769

sting doing you know mathematical work

1315

00:54:00,460 --> 00:53:58,910

and that they wanted to be able to do

1316

00:54:03,670 --> 00:54:00,470

the fun stuff running the wind tunnel

1317

00:54:05,589 --> 00:54:03,680

and and doing other things and so they

1318

00:54:07,359 --> 00:54:05,599

happen is it tried the women computers

1319

00:54:08,950 --> 00:54:07,369

is an experiment and it turns out they

1320

00:54:10,569 --> 00:54:08,960

were much when they when they were done

1321

00:54:12,160 --> 00:54:10,579

with the experiment after a few months

1322

00:54:14,410 --> 00:54:12,170

they realize the women were much more

1323

00:54:17,259 --> 00:54:14,420

accurate much faster and did a better

1324

00:54:19,089 --> 00:54:17,269

job and didn't complain and you could

1325

00:54:21,009 --> 00:54:19,099

pay them less and it actually got put in

1326

00:54:25,390 --> 00:54:21,019

a memo that isn't as great they do this

1327

00:54:27,250 --> 00:54:25,400

great work and within her cheap so the

1328

00:54:29,319 --> 00:54:27,260

training process was fairly

1329

00:54:31,299 --> 00:54:29,329

straightforward and done largely as

1330

00:54:32,710 --> 00:54:31,309

on-the-job training for those things but

1331

00:54:34,089 --> 00:54:32,720

they think most of had the skills they

1332

00:54:37,480 --> 00:54:34,099

needed to do that work to start with

1333

00:54:38,890 --> 00:54:37,490

okay Julie could you we've got a couple

1334

00:54:40,769 --> 00:54:38,900

of questions about this could you tell

1335

00:54:45,279 --> 00:54:40,779

us a little more about what kind of

1336

00:54:46,809 --> 00:54:45,289

training engineers at NASA do today both

1337

00:54:48,549 --> 00:54:46,819

in your degree and then when you when

1338

00:54:51,190 --> 00:54:48,559

you actually get here how do you keep

1339

00:54:53,019 --> 00:54:51,200

learning we have a variety of training

1340

00:54:56,319 --> 00:54:53,029

that we can we can do here at NASA

1341

00:54:58,059 --> 00:54:56,329

Langley both technical and and on the

1342

00:54:59,289 --> 00:54:58,069

art side and so I remember when I first

1343

00:55:01,539 --> 00:54:59,299

started here you know I had the

1344

00:55:03,279 --> 00:55:01,549

technical background but I understood

1345

00:55:05,380 --> 00:55:03,289

that there was a need to be a good

1346

00:55:07,720 --> 00:55:05,390

communicator as administrative all that

1347

00:55:09,579 --> 00:55:07,730

said so I I took many communication

1348

00:55:11,829 --> 00:55:09,589

classes because typically you work in a

1349

00:55:13,720 --> 00:55:11,839

team with a team of people and you have

1350

00:55:15,880 --> 00:55:13,730

to communicate effectively with them

1351  
00:55:18,370 --> 00:55:15,890  
when you're writing technical papers you

1352  
00:55:20,740 --> 00:55:18,380  
need to have that English and that that

1353  
00:55:22,749 --> 00:55:20,750  
that structure written down so that

1354  
00:55:24,970 --> 00:55:22,759  
known in your head so that you can write

1355  
00:55:26,740 --> 00:55:24,980  
technical papers and also at NASA you're

1356  
00:55:29,049 --> 00:55:26,750  
given a lot of opportunity to go to

1357  
00:55:30,670 --> 00:55:29,059  
international conferences and to

1358  
00:55:32,019 --> 00:55:30,680  
technical conferences and again you have

1359  
00:55:34,269 --> 00:55:32,029  
to be really really good at

1360  
00:55:36,999 --> 00:55:34,279  
communicating the work that you do and

1361  
00:55:38,589 --> 00:55:37,009  
so not only the technical work I can

1362  
00:55:41,980 --> 00:55:38,599  
always you can always go back to the

1363  
00:55:43,480 --> 00:55:41,990

school there's programs for PhDs if you

1364

00:55:45,519 --> 00:55:43,490

don't have a PhD or you can get your

1365

00:55:47,829 --> 00:55:45,529

advanced degrees there's a you know

1366

00:55:49,809 --> 00:55:47,839

there's a wealth of executive classes

1367

00:55:52,749 --> 00:55:49,819

that you can take as far as team

1368

00:55:54,460 --> 00:55:52,759

building and and in just the whole

1369

00:55:58,150 --> 00:55:54,470

wealth of classes as a matter of fact I

1370

00:55:59,829 --> 00:55:58,160

just signed up for a Python programming

1371

00:56:01,509 --> 00:55:59,839

class for January and I'm really looking

1372

00:56:05,450 --> 00:56:01,519

forward to that because the last time I

1373

00:56:08,280 --> 00:56:05,460

did any programming was 19

1374

00:56:09,780 --> 00:56:08,290

and I and I learned how to do Fortran

1375

00:56:12,200 --> 00:56:09,790

and I'm sure nobody here knows what no

1376

00:56:15,030 --> 00:56:12,210

Fortran is but I'm really excited about

1377

00:56:16,950 --> 00:56:15,040

about about Python so the training

1378

00:56:19,140 --> 00:56:16,960

continues you know you can continue to

1379

00:56:20,670 --> 00:56:19,150

do whatever you want to do and that's

1380

00:56:23,039 --> 00:56:20,680

one of the one of the great things of

1381

00:56:25,289 --> 00:56:23,049

working here at NASA is that they allow

1382

00:56:27,930 --> 00:56:25,299

you to continue to build and to grow and

1383

00:56:29,460 --> 00:56:27,940

to continue to you know contribute to

1384

00:56:34,260 --> 00:56:29,470

all of the different challenges that we

1385

00:56:37,470 --> 00:56:34,270

have as an organization so as we get

1386

00:56:40,319 --> 00:56:37,480

close to wrapping up here one more

1387

00:56:42,930 --> 00:56:40,329

question from Gmail how much your the

1388

00:56:45,510 --> 00:56:42,940

movie is true how much of this movie

1389

00:56:48,180 --> 00:56:45,520

actually happened I think we should ask

1390

00:56:49,620 --> 00:56:48,190

Ted that question I am Ted if you could

1391

00:56:51,480 --> 00:56:49,630

tell us just a little bit about you know

1392

00:56:54,120 --> 00:56:51,490

how much of this movie is real and why

1393

00:56:57,120 --> 00:56:54,130

you made the choices you did and telling

1394

00:57:00,450 --> 00:56:57,130

the story well I I think a lot of the

1395

00:57:03,720 --> 00:57:00,460

movie is accurate we worked very hard

1396

00:57:05,370 --> 00:57:03,730

with NASA with dr. berry and a lot of

1397

00:57:07,470 --> 00:57:05,380

it's accurate you know there are things

1398

00:57:10,140 --> 00:57:07,480

you there are things you do in a movie

1399

00:57:11,220 --> 00:57:10,150

that you have to do so like like let's

1400

00:57:13,829 --> 00:57:11,230

I'll give you an example

1401  
00:57:17,250 --> 00:57:13,839  
Catherine Johnson was confirming John

1402  
00:57:20,460 --> 00:57:17,260  
Glenn's numbers for his first orbital

1403  
00:57:23,670 --> 00:57:20,470  
flight that those calculations took

1404  
00:57:26,099 --> 00:57:23,680  
three days I don't think anyone want to

1405  
00:57:29,819 --> 00:57:26,109  
sit through a three day movie so we

1406  
00:57:31,859 --> 00:57:29,829  
compress that three days into 25 seconds

1407  
00:57:33,809 --> 00:57:31,869  
those are the things that you have to

1408  
00:57:35,789 --> 00:57:33,819  
stretch and change in the movie in order

1409  
00:57:38,069 --> 00:57:35,799  
for a movie at work but in terms of the

1410  
00:57:40,079 --> 00:57:38,079  
facts and what happened in the movie and

1411  
00:57:43,620 --> 00:57:40,089  
how all the characters live their lives

1412  
00:57:46,559 --> 00:57:43,630  
that is all 100% accurate and a lot of

1413  
00:57:48,450 --> 00:57:46,569

the big quotes what John Glenn said

1414

00:57:51,839 --> 00:57:48,460

about Katherine get get the girl to run

1415

00:57:53,640 --> 00:57:51,849

the numbers what jim johnson says to his

1416

00:57:55,799 --> 00:57:53,650

wife of what before he marries in which

1417

00:57:57,780 --> 00:57:55,809

i won't give away cuz it's a spoiler but

1418

00:57:59,609 --> 00:57:57,790

these things are all hundred percent

1419

00:58:01,740 --> 00:57:59,619

accurate so we did the very best we

1420

00:58:04,410 --> 00:58:01,750

could but you know granted it is a movie

1421

00:58:06,599 --> 00:58:04,420

as it is meant to entertain so we hope

1422

00:58:09,690 --> 00:58:06,609

we hope we did a good job that bill

1423

00:58:12,329 --> 00:58:09,700

would know how close we got a lot of the

1424

00:58:15,180 --> 00:58:12,339

technical things all right bill you want

1425

00:58:17,910 --> 00:58:15,190

to add anything in a few seconds I'll

1426  
00:58:20,940 --> 00:58:17,920  
say that I was stunned by the degree to

1427  
00:58:23,490 --> 00:58:20,950  
Ted and his team of production staff as

1428  
00:58:25,230 --> 00:58:23,500  
well we're focused on every little

1429  
00:58:27,450 --> 00:58:25,240  
detail about things trying to get the

1430  
00:58:30,180 --> 00:58:27,460  
look in the field and the equipment that

1431  
00:58:32,370 --> 00:58:30,190  
was being used and the conversation the

1432  
00:58:35,039 --> 00:58:32,380  
technology all those faces they did a

1433  
00:58:36,030 --> 00:58:35,049  
phenomenal job and and made a great

1434  
00:58:38,430 --> 00:58:36,040  
movie out of it as well

1435  
00:58:39,690 --> 00:58:38,440  
great all right well thank you all so

1436  
00:58:41,819 --> 00:58:39,700  
much that's all the time we have for

1437  
00:58:46,200 --> 00:58:41,829  
today but for more information on this

1438  
00:58:49,710 --> 00:58:46,210

part of nasa's history visit WWN a Sega

1439

00:58:51,630 --> 00:58:49,720

/ modern figures thanks to our panel for