



# SILICON VALLEY

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P O D C A S T

1  
00:00:00,079 --> 00:00:05,730  
welcome to NASA in Silicon Valley  
episode 61 for the last few episodes

2  
00:00:05,730 --> 00:00:10,469  
we've been asking for input on our fancy  
new phone line so we have our first

3  
00:00:10,469 --> 00:00:16,740  
caller Raj who dialed six five zero six  
zero four one four zero zero just like

4  
00:00:16,740 --> 00:00:22,289  
you can and he left this message  
oh hi my name is Raj RNG I'm calling the

5  
00:00:22,289 --> 00:00:27,840  
Seattle recording I'm just following  
with interest p.m. podcast on the

6  
00:00:27,840 --> 00:00:34,380  
Cassini grand finale I have one question  
I with the current state of the

7  
00:00:34,380 --> 00:00:40,020  
technology if there is a future mission  
like a semi is to the outer planets are

8  
00:00:40,020 --> 00:00:44,309  
really in a position to design in such a  
way that the energy source never runs

9  
00:00:44,309 --> 00:00:49,320  
out for example for the solar energy  
will that be possible that you can

10  
00:00:49,320 --> 00:00:52,199  
design an orbiter which will just keep  
going forever

11  
00:00:52,199 --> 00:00:57,629  
and given the longevity of the Voyager  
probes so is there something like that

12  
00:00:57,629 --> 00:01:01,890  
is in on the cards so that you don't  
have to really do such a wonderful

13  
00:01:01,890 --> 00:01:05,400  
instrument which is still functioning  
otherwise joining us for this special

14  
00:01:05,400 --> 00:01:10,710  
intro is Chad frost the deputy director  
for engineering here at NASA Ames

15  
00:01:10,710 --> 00:01:15,509  
so Chad tell us what do you think would  
it make more sense to use solar power

16  
00:01:15,509 --> 00:01:19,830  
for stuff like Cassini hey Matt well  
Roger asked a really great question and

17  
00:01:19,830 --> 00:01:23,939  
it's not just about can you use solar  
power I mean really his question was how

18  
00:01:23,939 --> 00:01:29,189  
do you keep a mission going indefinitely  
yeah and okay could power from the Sun

19  
00:01:29,189 --> 00:01:32,700  
be the solution to doing that and that  
that's a great question and those are

20  
00:01:32,700 --> 00:01:37,009  
the kinds of questions we have to think  
about all the time for NASA missions and

21  
00:01:37,009 --> 00:01:41,790  
really when we're planning a mission out  
into deep space one of the real

22  
00:01:41,790 --> 00:01:47,280  
considerations is actually the ongoing  
cost to operate that spacecraft over the

23  
00:01:47,280 --> 00:01:52,110  
lifetime of the mission so a spacecraft  
that can function and collect science

24  
00:01:52,110 --> 00:01:56,880  
data for a really long time compute just  
incredibly valuable and Voyager 1 and

25  
00:01:56,880 --> 00:02:01,710  
Voyager 2 those are great examples  
they've been out there for 40 years this

26  
00:02:01,710 --> 00:02:07,380  
month in regular communication with NASA  
but that does cost something for the

27  
00:02:07,380 --> 00:02:10,899  
people and the facilities to make all  
that happen

28  
00:02:10,899 --> 00:02:15,970  
there's also a cost associated with  
building a spacecraft that can last in

29  
00:02:15,970 --> 00:02:21,430  
the heat the cold the radiation of the  
space environment and it takes quite a

30  
00:02:21,430 --> 00:02:27,160  
bit more to engineer and build a system  
that's so reliable so typically we will

31

00:02:27,160 --> 00:02:32,140

design a spacecraft to perform a particular mission get the science we

32

00:02:32,140 --> 00:02:38,050

want and then wrap up yeah Cassini is one example of that and ladee mission is

33

00:02:38,050 --> 00:02:42,970

another there's lots when the missions over it's over and that means the you

34

00:02:42,970 --> 00:02:45,790

know the the meter doesn't keep ticking mm-hmm

35

00:02:45,790 --> 00:02:50,799

sometimes an open-end mission is the right thing to do and the Voyager

36

00:02:50,799 --> 00:02:55,510

missions are great examples but there is a cost associated with doing that so one

37

00:02:55,510 --> 00:02:59,590

of the challenges for missions to the outer planets is that the power

38

00:02:59,590 --> 00:03:05,470

available from the Sun decreases with the square of the distance okay and the

39

00:03:05,470 --> 00:03:10,450

further out we go the less power we have to work with yeah it's weaker and weaker

40

00:03:10,450 --> 00:03:15,970

it's weaker and weaker and NASA's Juno spacecraft for example which generate 14

41  
00:03:15,970 --> 00:03:21,160  
kilowatts of power you know of  
electricity if it were in Earth orbit

42  
00:03:21,160 --> 00:03:25,780  
right but by the time it gets out to  
Jupiter it can only produce 400 watts

43  
00:03:25,780 --> 00:03:31,180  
right about the same as a blender okay  
not very much in a very expensive blend

44  
00:03:31,180 --> 00:03:36,579  
a very expensive blender so additionally  
I not only is the energy available from

45  
00:03:36,579 --> 00:03:40,810  
the Sun going down really fast as you  
get further out the solar cell

46  
00:03:40,810 --> 00:03:46,690  
efficiency degrades over time that it's  
exposed to the space environment and it

47  
00:03:46,690 --> 00:03:51,670  
takes several years to get out that far  
so the amount of electricity that you

48  
00:03:51,670 --> 00:03:57,970  
can generate from your solar cells is  
going down too so what this means is you

49  
00:03:57,970 --> 00:04:01,660  
know as you go out past about the orbit  
of Jupiter

50  
00:04:01,660 --> 00:04:07,750  
you either need truly huge solar arrays  
which with today's technology we just we

51  
00:04:07,750 --> 00:04:12,280  
can't get them up into space but we're  
working on it yeah or we need some other

52  
00:04:12,280 --> 00:04:16,870  
source of power fortunately we have  
what's called an RTG a radioisotope

53  
00:04:16,870 --> 00:04:23,990  
thermoelectric from the heat generated  
by radioactive materials Oh

54  
00:04:23,990 --> 00:04:29,479  
these work great we've been using them  
since the 1960's and ever since but

55  
00:04:29,479 --> 00:04:34,729  
they're really heavy and they're really  
expensive and even those eventually stop

56  
00:04:34,729 --> 00:04:39,169  
making enough power to be useful that  
takes decades but still eventually right

57  
00:04:39,169 --> 00:04:45,110  
there is an endpoint yeah so the other  
limiting factor on the lifetime of a

58  
00:04:45,110 --> 00:04:51,710  
spacecraft is its supply of propellant  
spacecraft need propellant to perform

59  
00:04:51,710 --> 00:04:56,720  
maneuvers and once all that propellant  
is expended the spacecraft can't point

60  
00:04:56,720 --> 00:05:02,060  
can't change its trajectory and even  
electric propulsion systems which are

61  
00:05:02,060 --> 00:05:07,099  
very efficient and we use a lot now  
because of their efficiency they require

62  
00:05:07,099 --> 00:05:10,580  
some form of propellant when it's all  
used up

63  
00:05:10,580 --> 00:05:15,560  
the missions effectively over because  
the spacecraft can't point back to earth

64  
00:05:15,560 --> 00:05:19,580  
to do its communications for example  
even if the rest of the spacecraft

65  
00:05:19,580 --> 00:05:23,539  
systems are all working just fine once  
the propellants gone that's kind of it

66  
00:05:23,539 --> 00:05:28,219  
so you know these are all great  
challenges there are things we have to

67  
00:05:28,219 --> 00:05:34,460  
work through for any deep-space mission  
and I think the the key to key answer to

68  
00:05:34,460 --> 00:05:40,969  
Raj's question is you know if we could  
have them last forever we would yeah it

69  
00:05:40,969 --> 00:05:45,259  
costs something to do that  
yeah and it's a real hard technology

70  
00:05:45,259 --> 00:05:50,690  
problem so if the science warrants it  
NASA will go for it a lot of times you

71  
00:05:50,690 --> 00:05:56,120  
just want to go out get the science and  
be done with it well thanks for coming

72  
00:05:56,120 --> 00:06:00,020  
on over Chad I'm sure this isn't going  
to be the last that we hear from Chad

73  
00:06:00,020 --> 00:06:04,400  
Frost my pleasure Matt any time but also a  
reminder to folks listening to keep

74  
00:06:04,400 --> 00:06:09,050  
calling in and who knows maybe we'll end  
up doing a full episode just for calls

75  
00:06:09,050 --> 00:06:14,659  
and and input and feedback and answers  
and stuff but for this episode we are

76  
00:06:14,659 --> 00:06:19,130  
joined by Leighton Quon he is a project  
manager in the air space technology

77  
00:06:19,130 --> 00:06:22,580  
division at NASA Ames we talk a lot  
about his research and work on the

78  
00:06:22,580 --> 00:06:26,630  
nation's air traffic management systems  
and I think we can all relate to sitting

79  
00:06:26,630 --> 00:06:31,009  
on long flights and annoying lay overs  
but Leighton's work is targeted at making

80  
00:06:31,009 --> 00:06:35,900  
air traffic systems safer faster and  
more efficient so let's jump right into

81  
00:06:35,900 --> 00:06:49,420  
our conversation with Leighton Quon

82  
00:06:49,420 --> 00:06:55,210  
how did you join NASA how did you end up  
in Silicon Valley well I'll go in the

83  
00:06:55,210 --> 00:07:00,760  
reverse order I born and raised in the  
area so I'm a local born and raised spent

84  
00:07:00,760 --> 00:07:07,000  
all but a couple years of my life in the  
area okay including school so I am a

85  
00:07:07,000 --> 00:07:12,160  
local and that's why I'm here  
I came to NASA I had been working as so

86  
00:07:12,160 --> 00:07:17,950  
my degrees are in engineering I had been  
working in the Silicon Valley area for a

87  
00:07:17,950 --> 00:07:22,720  
number of years in industry mm-hmm in  
fact half of my career is still in on

88  
00:07:22,720 --> 00:07:26,890  
the industry side before I eventually  
came to civil service but I was working

89  
00:07:26,890 --> 00:07:32,770  
in areas that are that that NASA here at  
Ames Research Center had a need for at

90  
00:07:32,770 --> 00:07:36,460  
that point in my career was largely  
modeling and simulation simulations of

91

00:07:36,460 --> 00:07:42,100  
aircraft and those types of things  
they're also our transportation types of

92  
00:07:42,100 --> 00:07:46,540  
simulation so I had been working in that  
area in industry and eventually there

93  
00:07:46,540 --> 00:07:51,040  
was an opportunity and bring it over  
yeah to come over to Civil Service and

94  
00:07:51,040 --> 00:07:55,540  
continue doing similar work but at a  
higher level and so kind of as a career

95  
00:07:55,540 --> 00:08:00,670  
move it it just made sense at that time  
oh cool so um yeah I'd imagine

96  
00:08:00,670 --> 00:08:04,210  
especially growing up in this area if  
you're driving 101 you see these big

97  
00:08:04,210 --> 00:08:07,420  
hangars and to kind of wonder like  
what's going on back over there behind

98  
00:08:07,420 --> 00:08:12,400  
that fence yep yep in fact I remember  
driving up and down 101 when you know

99  
00:08:12,400 --> 00:08:17,740  
the the cities of San Jose in San  
Francisco and the suburbs did not touch

100  
00:08:17,740 --> 00:08:21,220  
each other there would be open space oh  
wow before you would get to the next

101

00:08:21,220 --> 00:08:27,610  
suburb and a lot of orchards and yeah  
and just open open space 101 north and

102  
00:08:27,610 --> 00:08:30,490  
southbound was only three lanes at that  
time oh wow

103  
00:08:30,490 --> 00:08:34,660  
and yeah as you went by this this area  
you could see the big hangar was very

104  
00:08:34,660 --> 00:08:40,120  
prominent mm-hmm so I mean imagine you  
you know haven't worked in industry for

105  
00:08:40,120 --> 00:08:43,630  
a while you know that NASA is a thing  
you know the work that they're doing in

106  
00:08:43,630 --> 00:08:49,390  
aeronautics and so did you just see a  
job or did somebody come approach you

107  
00:08:49,390 --> 00:08:54,250  
say hey maybe think this would be a good  
fit well I mean the first step was I

108  
00:08:54,250 --> 00:08:57,660  
mean I was in industry not even related  
to

109  
00:08:57,660 --> 00:09:02,480  
NASA work Ames research it was some  
defense and other government work

110  
00:09:02,480 --> 00:09:08,160  
eventually I did work begin doing work  
that was supported and done by NASA but

111

00:09:08,160 --> 00:09:12,690

I was not yet working for NASA as a  
civil servant and then as time went on

112

00:09:12,690 --> 00:09:16,800

there were there were there were  
opportunities you know that were well

113

00:09:16,800 --> 00:09:19,790

aligned with what I was doing and kind  
of where I wanted to go with my career

114

00:09:19,790 --> 00:09:24,780

so there was an opportunity that I I  
took advantage of and that was when I

115

00:09:24,780 --> 00:09:27,870

transitioned to civil service and so  
when you came on board what were you

116

00:09:27,870 --> 00:09:33,780

working on well I came on board to  
become the deputy project manager for

117

00:09:33,780 --> 00:09:38,190

the virtual aerospace modeling and  
simulation project okay VAMS quite a

118

00:09:38,190 --> 00:09:43,260

mouthful so what exactly does that do  
well we were focusing that project

119

00:09:43,260 --> 00:09:48,540

focused on it was actually a fairly  
descriptive title yeah air air space as

120

00:09:48,540 --> 00:09:52,490

in the air traffic management and air  
traffic that we have in this country

121

00:09:52,490 --> 00:09:58,020  
modeling and simulations of developing  
modeling of that developing simulation

122  
00:09:58,020 --> 00:10:02,400  
and simulation tools to better  
understand and analyze the system the

123  
00:10:02,400 --> 00:10:10,320  
air transportation system and to propose  
propose and look into future concepts of

124  
00:10:10,320 --> 00:10:16,320  
operation to make their transportation  
more efficient and and utilize more

125  
00:10:16,320 --> 00:10:20,520  
technology than then that currently had  
well it's it's one of those funny things

126  
00:10:20,520 --> 00:10:24,420  
and people typically think of NASA they  
think of astronauts and launching

127  
00:10:24,420 --> 00:10:30,410  
rockets leaving out that you know that's  
a core part of the acronym NASA

128  
00:10:30,410 --> 00:10:36,660  
Aeronautics being a huge part of that  
but also when you think of air traffic

129  
00:10:36,660 --> 00:10:41,790  
controllers I think people first place  
their mind goes to the FAA in a lot of

130  
00:10:41,790 --> 00:10:45,630  
the work that NASA is doing is a lot of  
some of that research that helps helps

131

00:10:45,630 --> 00:10:50,340  
that you know those air traffic control  
systems and sync with the FAA talked a

132  
00:10:50,340 --> 00:10:54,090  
little bit about that well and that's  
correct I mean at the stage in the

133  
00:10:54,090 --> 00:10:58,710  
relationship we're at with the FAA so  
first of all yes NASA the first A in

134  
00:10:58,710 --> 00:11:03,420  
NASA is aeronautics National Aeronautics  
and Space Administration so we're very

135  
00:11:03,420 --> 00:11:09,240  
happy and proud about that  
so I'm glad you had a chance to allude to

136  
00:11:09,240 --> 00:11:13,540  
that right now our current relationship  
with the FAA is actually quite

137  
00:11:13,540 --> 00:11:17,240  
strong it's probably stronger than it's  
ever been and it's related to the air

138  
00:11:17,240 --> 00:11:22,279  
traffic management and the research  
there you know in a in broad statements

139  
00:11:22,279 --> 00:11:27,769  
you know the FAA is responsible for the  
implementation and safe operation of the

140  
00:11:27,769 --> 00:11:32,569  
air traffic management air  
transportation system we're helping out

141

00:11:32,569 --> 00:11:36,319  
a being a government research agency by  
doing some early research and

142  
00:11:36,319 --> 00:11:43,069  
development for future air traffic  
management systems of all sorts some of

143  
00:11:43,069 --> 00:11:47,660  
them are things for the FAA and the air  
traffic controller systems and the

144  
00:11:47,660 --> 00:11:54,009  
things they rely on some of them may be  
onboard flight decks and aircraft for

145  
00:11:54,009 --> 00:11:59,329  
operational efficiency things there's  
additional research related to just

146  
00:11:59,329 --> 00:12:03,410  
aviation safety in general and  
technologies that can be applied there

147  
00:12:03,410 --> 00:12:09,319  
both on the ground as well as as in the  
air onboard air individual aircraft so

148  
00:12:09,319 --> 00:12:15,589  
it's it's quite a broad portfolio of  
work and in addition to that a lot of

149  
00:12:15,589 --> 00:12:20,839  
the traditional work that we've always  
done is is still there with respect to

150  
00:12:20,839 --> 00:12:27,199  
aerodynamics aerodynamics of  
design of wings of aircraft bodies

151

00:12:27,199 --> 00:12:33,259  
aircraft shapes efficiency issues with  
moving something through the air as well

152  
00:12:33,259 --> 00:12:38,120  
as future airplane designs those are all  
still part of NASA's Aeronautics

153  
00:12:38,120 --> 00:12:42,199  
portfolio well and also one thing that  
comes to mind of having have these

154  
00:12:42,199 --> 00:12:46,910  
conversations with different people in  
different parts of NASA Ames the folks

155  
00:12:46,910 --> 00:12:51,230  
working like supercomputing and stuff  
I'd imagine that you know not every

156  
00:12:51,230 --> 00:12:56,240  
government agency has a supercomputer on  
hand so you guys would you guys work

157  
00:12:56,240 --> 00:12:59,180  
with that on some of this research and  
you talked about modeling and

158  
00:12:59,180 --> 00:13:02,029  
simulations does that play into it a  
little bit

159  
00:13:02,029 --> 00:13:06,110  
only a little bit but we do yeah we do  
in fact have sometimes we have

160  
00:13:06,110 --> 00:13:09,920  
computations that are very very  
demanding yeah that kind of go beyond

161

00:13:09,920 --> 00:13:16,430  
the the ability or scope of kind of  
standard computing class hardware so we

162  
00:13:16,430 --> 00:13:22,309  
have we do and we have used the  
supercomputing facilities here for

163  
00:13:22,309 --> 00:13:27,130  
various analyses and that kind of comes and goes  
depending on what worse than what the

164  
00:13:27,130 --> 00:13:33,130  
need is as far as kind of the  
operational studies through the ages

165  
00:13:33,130 --> 00:13:36,340  
through the years in fact that first  
project that got me to come to Civil

166  
00:13:36,340 --> 00:13:41,980  
Service was was about building modeling  
and simulation capabilities that could

167  
00:13:41,980 --> 00:13:49,210  
support the research we envision in the  
future now that that was in 2003 and in

168  
00:13:49,210 --> 00:13:53,890  
the future now we are and I will say I'm  
happy and pleased to say we're actually

169  
00:13:53,890 --> 00:13:59,410  
leveraging in my current project a lot  
of the ground work that we did back in

170  
00:13:59,410 --> 00:14:05,110  
the early 2000s related to modeling and  
simulation so it's proving valuable to

171

00:14:05,110 --> 00:14:10,150  
us what we did before yeah in our  
current research and I know we continue

172  
00:14:10,150 --> 00:14:13,930  
we the you know kind of the Aeronautics  
research here we continue to look at

173  
00:14:13,930 --> 00:14:19,090  
better and future ways to do simulations  
and that's that's a different that's

174  
00:14:19,090 --> 00:14:22,930  
another project so build on it so what  
were you working on before but and then

175  
00:14:22,930 --> 00:14:27,400  
how did that help pave the way for the  
stuff that you're doing now is it just

176  
00:14:27,400 --> 00:14:31,390  
focuses mainly on just like how to do  
research how to do simulations or oh

177  
00:14:31,390 --> 00:14:35,650  
well so if you're referring to the  
earlier project that you mentioned yeah

178  
00:14:35,650 --> 00:14:39,880  
I mean it was a common it was actually a  
lot of the precursor work to what we're

179  
00:14:39,880 --> 00:14:45,940  
doing now in that project we had three  
areas of focus one was actually modeling

180  
00:14:45,940 --> 00:14:50,680  
and simulation what types of tools do we  
need to support the research we

181

00:14:50,680 --> 00:14:55,390  
anticipate for the future okay and a  
future proofing it a little right one

182  
00:14:55,390 --> 00:15:01,090  
was system level integrated concepts so  
that was more about their transportation

183  
00:15:01,090 --> 00:15:07,600  
system in itself and how certain  
concepts new concepts could be looked at

184  
00:15:07,600 --> 00:15:12,760  
entertain developed mm-hmm and then  
presumably tested in our simulation

185  
00:15:12,760 --> 00:15:17,200  
facility yeah and then ways to evaluate  
those new concepts so we had an

186  
00:15:17,200 --> 00:15:22,870  
evaluation focus in there so it was the  
modeling and simulation tools and

187  
00:15:22,870 --> 00:15:29,080  
support the con new concepts to try  
within that facility or those facilities

188  
00:15:29,080 --> 00:15:35,080  
and then the way ways to evaluate kind  
of the goodness of those yeah those

189  
00:15:35,080 --> 00:15:38,060  
future concepts and then on the stuff  
that you guys

190  
00:15:38,060 --> 00:15:42,710  
research the stuff you guys are studying  
how do those questions come about

191

00:15:42,710 --> 00:15:47,600  
because is it stuff that you know  
researchers at NASA come up with or is

192  
00:15:47,600 --> 00:15:50,930  
this FAA saying hey here's a problem  
that we're having or is it private

193  
00:15:50,930 --> 00:15:55,550  
industry like how what formula what  
drives the questions that you end up

194  
00:15:55,550 --> 00:16:00,410  
looking at and research it's actually all  
of those all of the above the things

195  
00:16:00,410 --> 00:16:04,340  
that we look at if you look at the  
entirety of the portfolio even beyond

196  
00:16:04,340 --> 00:16:08,600  
what I have within Aeronautics you you  
could find examples of all of those

197  
00:16:08,600 --> 00:16:13,370  
things really in my portfolio which is  
now the airspace technology

198  
00:16:13,370 --> 00:16:19,730  
demonstrations project or ATD project a  
lot of what we work on is maturing the

199  
00:16:19,730 --> 00:16:24,800  
reef foundational research that some of  
our researchers worked on five and ten

200  
00:16:24,800 --> 00:16:29,960  
years ago and now it's kind of coming to  
fruition and ready to be evaluated and

201

00:16:29,960 --> 00:16:36,680

tried in the field so in my portfolio a lot of times we do work with the FAA the

202

00:16:36,680 --> 00:16:41,150

FA comes to us with you know hey we're we're struggling in this area or we

203

00:16:41,150 --> 00:16:44,630

understood you had some foundational research in this area we'd like we'd

204

00:16:44,630 --> 00:16:49,190

like to pull that along we'd like you to help us pull that along and so in my

205

00:16:49,190 --> 00:16:53,090

portfolio there's a lot of that there's a lot of industry since you know air

206

00:16:53,090 --> 00:16:58,700

transportation is you know as a traveler we're all on somebody's airline or an

207

00:16:58,700 --> 00:17:04,610

airplane and if we're not some goods that we either are wearing or touching

208

00:17:04,610 --> 00:17:10,550

or buy or eating a hair eating have been in a plane at some point in time so you

209

00:17:10,550 --> 00:17:14,510

know they're very strong stakeholders in the overall system and it's a lot of the

210

00:17:14,510 --> 00:17:20,210

work we do could be generated by their their needs and discussions with them on

211

00:17:20,210 --> 00:17:24,920  
what what they think some of the  
priorities are missing missing missing

212  
00:17:24,920 --> 00:17:28,850  
things are some of the gaps some of the  
operational problems they deal with and

213  
00:17:28,850 --> 00:17:34,450  
then our researchers you know are quite  
brilliant and just studying the system

214  
00:17:34,450 --> 00:17:40,940  
and finding issues and problems with it  
based on their own research and studies

215  
00:17:40,940 --> 00:17:44,660  
and so a lot of times those will  
generate yeah kind of what I've referred

216  
00:17:44,660 --> 00:17:49,250  
to as foundational research they one  
find the problem and two propose a

217  
00:17:49,250 --> 00:17:51,380  
solution and start doing the research on  
that

218  
00:17:51,380 --> 00:17:56,360  
as that matures it can gain in  
visibility by those other entities the

219  
00:17:56,360 --> 00:18:01,700  
FAA or industry and sake yeah yeah  
you're right we need that yeah and some

220  
00:18:01,700 --> 00:18:07,970  
of that research can like then evolve  
into demonstrations practice and then

221

00:18:07,970 --> 00:18:12,710  
eventually sometime down the line actual  
implementation on like okay here's the

222  
00:18:12,710 --> 00:18:17,330  
research here's our tests this is how it  
should be actually used right and and

223  
00:18:17,330 --> 00:18:22,390  
actually so my current project that I  
managed ATD project air transport

224  
00:18:22,390 --> 00:18:28,250  
airspace technology demonstrations project we're  
focused kind of on that tail end where

225  
00:18:28,250 --> 00:18:34,400  
the technology the research is becoming  
mature okay and it's ready to be kind of

226  
00:18:34,400 --> 00:18:38,210  
developed and tested may be demonstrated  
and you know that's why the names are

227  
00:18:38,210 --> 00:18:43,220  
all in there yeah either in very mature  
systems that we had and that nASA has

228  
00:18:43,220 --> 00:18:50,240  
here or we have access to as well as  
field systems may be going out into the

229  
00:18:50,240 --> 00:18:55,190  
field at an airport or had an airline  
and trying are demonstrating and trying

230  
00:18:55,190 --> 00:19:00,290  
our systems there or even working with  
the FAA in their labs which you know

231

00:19:00,290 --> 00:19:06,890  
most of their labs actually have the  
fielded systems that the FA uses but we

232  
00:19:06,890 --> 00:19:11,120  
have the opportunity to get in there  
with with them when work jointly to you

233  
00:19:11,120 --> 00:19:15,080  
know prove the feasibility of not only  
the the concept but that it can be

234  
00:19:15,080 --> 00:19:20,160  
embedded into their baseline systems and  
so talk a little bit about it about ATD

235  
00:19:20,160 --> 00:19:25,280  
ATD I know there's ATD one ATD two  
I believe it was some testing going on

236  
00:19:25,280 --> 00:19:31,430  
in Charlotte and we're working at ATD three so for folks who have no clue what is

237  
00:19:31,430 --> 00:19:38,240  
ATD and go through like the progress  
and where we're at okay ATD one focused

238  
00:19:38,240 --> 00:19:45,140  
on what we call arrival arrival  
technology so as as you're traveling to

239  
00:19:45,140 --> 00:19:50,330  
somewhere by air air mm-hmm you're in  
the airplane the last hundred to fifty miles

240  
00:19:50,330 --> 00:19:56,300  
in getting to the airport generally sees  
a lot of congestion especially the busy

241  
00:19:56,300 --> 00:20:03,500

airports yes yes I mean holidays and  
stuff exact so ATD one focused on three main

242

00:20:03,500 --> 00:20:07,010

technologies to address  
kind of the rush hour and trying to

243

00:20:07,010 --> 00:20:12,500

arrive at a busy airport area it was  
there's something we called terminal

244

00:20:12,500 --> 00:20:17,060

sequencing and spacing which is a master  
schedule that every that now gets

245

00:20:17,060 --> 00:20:22,070

broadcast to everybody the controllers  
and things like that so everybody kind

246

00:20:22,070 --> 00:20:26,890

of knows where everybody should be when  
okay in addition to that there were

247

00:20:26,890 --> 00:20:32,360

controller side tools that help show the  
controllers not only the schedule that I

248

00:20:32,360 --> 00:20:36,890

just mentioned but on their radar  
screens kind of little markers where

249

00:20:36,890 --> 00:20:41,420

each aircraft should be to adhere to  
that schedule and then on the flight

250

00:20:41,420 --> 00:20:45,290

deck we had flight deck interval  
management tools these were tools for

251

00:20:45,290 --> 00:20:52,010

the flight crews that gave them speed cues in order to accurately position

252

00:20:52,010 --> 00:20:56,720

themselves behind another aircraft lead aircraft okay and that it's utilizing

253

00:20:56,720 --> 00:21:02,870

ADSB technology which is a big a big buzzword now and automatic dependent

254

00:21:02,870 --> 00:21:06,800

surveillance broadcast it's the the higher precision satellite based

255

00:21:06,800 --> 00:21:12,140

positioning equipment okay everybody's beginning to move to so by having those

256

00:21:12,140 --> 00:21:17,330

three things the schedule you know where everybody should be yeah the tools for

257

00:21:17,330 --> 00:21:22,060

the controllers and the tools for the flight crews all on the same page they're

258

00:21:22,060 --> 00:21:29,530

the efficiency and moving into these very busy airports is is helped

259

00:21:29,530 --> 00:21:34,370

measurably and you guys actually tested that that was a couple years a couple

260

00:21:34,370 --> 00:21:38,930

months ago or a year ago well the the to face the ground side tools that I

261

00:21:38,930 --> 00:21:44,660

mentioned for the controllers they went  
to the FAA a couple years ago we

262

00:21:44,660 --> 00:21:48,170

transferred those technology to the FAA  
and those are in their implementation

263

00:21:48,170 --> 00:21:54,080

pipeline already in fact for the for the  
ground tools initial operating

264

00:21:54,080 --> 00:21:59,120

capability at the first sight is  
scheduled for second quarter of fiscal

265

00:21:59,120 --> 00:22:06,020

year 19 so it's it's it's coming up  
so we're very happy about that what we

266

00:22:06,020 --> 00:22:09,290

were what we were doing just a couple  
months ago or January late January early

267

00:22:09,290 --> 00:22:13,640

February we were actually flying the  
first prototype of the flight deck you

268

00:22:13,640 --> 00:22:19,370

noble management hardware and software  
we were up in the Pacific Northwest the

269

00:22:19,370 --> 00:22:25,190

Seattle area yeah yeah and that what was  
exciting about that is new procedures

270

00:22:25,190 --> 00:22:30,590

with new hardware prototype hardware  
with prototype software flying those new

271

00:22:30,590 --> 00:22:37,580

procedures on three aircraft so we had  
the ADSB the aircraft have to broadcast

272

00:22:37,580 --> 00:22:43,700

their position so that's ADSP so we had  
a lead aircraft which was a falcon 900

273

00:22:43,700 --> 00:22:50,929

jet we were engaged in a collaborative  
and contracted effort with Boeing that

274

00:22:50,929 --> 00:22:56,030

included Honeywell in United Airlines  
mm-hmm so Honeywell provided a falcon

275

00:22:56,030 --> 00:23:03,320

900 jet to be the lead and then a 757  
Boeing 757 flight test aircraft with the

276

00:23:03,320 --> 00:23:06,890

new equipment on it  
spacing behind the Falcon and then

277

00:23:06,890 --> 00:23:12,740

United Airlines following the leader  
provided yeah provided a an aircraft

278

00:23:12,740 --> 00:23:17,870

they pulled right out of service  
we installed prototype hardware in the

279

00:23:17,870 --> 00:23:24,770

cockpit and we were able to have them  
fly and follow most of the times the 757

280

00:23:24,770 --> 00:23:29,510

but it just needed an ADSP aircraft to  
follow and not only like you know the

281

00:23:29,510 --> 00:23:34,340

private sector of folks and you know FAA  
but even within NASA I remember I think

282

00:23:34,340 --> 00:23:41,240

NASA Langley also had a lot of work and  
yeah well in fact ATD one was a great joint

283

00:23:41,240 --> 00:23:46,850

effort between NASA Ames and Langley  
Research Centers Ames focused on the

284

00:23:46,850 --> 00:23:49,220

schedule  
the grant the schedule and the

285

00:23:49,220 --> 00:23:54,020

controller tools and Langley focused on  
the flight deck interval management or

286

00:23:54,020 --> 00:23:58,909

the flight deck tools so that's which is  
what we were flying in January February

287

00:23:58,909 --> 00:24:05,630

of this year so yeah that was a very big  
effort I know that we had the associate

288

00:24:05,630 --> 00:24:10,640

administrator for aeronautics out there  
and I had forgotten but he reminded me

289

00:24:10,640 --> 00:24:15,530

he used to do flight test oh really  
and as a flight test engineer many many

290

00:24:15,530 --> 00:24:21,320

years ago and he just had this brief you  
know story of you know I used to think

291

00:24:21,320 --> 00:24:27,140

it was hard for me to fly an icing  
anti-icing experiment on one aircraft I

292

00:24:27,140 --> 00:24:29,600

can't believe how well you guys are  
doing

293

00:24:29,600 --> 00:24:34,100

flying three aircraft coordinating three  
aircraft in a flight test of this

294

00:24:34,100 --> 00:24:38,929

magnitude with prototype hardware and  
software so he was very pleased to see

295

00:24:38,929 --> 00:24:42,950

that progress and that makes sense if  
you think of you know air traffic

296

00:24:42,950 --> 00:24:47,480

controlling especially if it's bad  
weather or you know during holiday

297

00:24:47,480 --> 00:24:51,289

season  
crazy congestion if you can start like

298

00:24:51,289 --> 00:24:55,490

finding some efficiencies on you know  
that's spacing between airplanes if

299

00:24:55,490 --> 00:24:58,700

they're pacing behind each other at the  
right length and almost in some ways

300

00:24:58,700 --> 00:25:03,020

automating some of that stuff you know  
just having a better control of

301

00:25:03,020 --> 00:25:07,760

understanding where and everything goes  
that means less time sitting in an

302

00:25:07,760 --> 00:25:12,409

airport delays it's less time you know  
it's like safer more fuel efficient

303

00:25:12,409 --> 00:25:16,520

there's all kinds of benefits you can  
get by just kind of modifying these

304

00:25:16,520 --> 00:25:22,640

procedures yeah yeah yeah exactly and  
again it really works it's it's it's at

305

00:25:22,640 --> 00:25:26,659

its best at the busiest times which was  
always the hardest hardest problem for

306

00:25:26,659 --> 00:25:29,809

everybody  
including the passenger sitting in back

307

00:25:29,809 --> 00:25:33,470

you know yes best analogy I heard is  
you're sitting in the middle seat

308

00:25:33,470 --> 00:25:38,750

you've come cross-country yes in five  
hours you're about to land and all of a

309

00:25:38,750 --> 00:25:42,770

sudden you feel the aircraft make a  
right turn because it got too busy and

310

00:25:42,770 --> 00:25:46,340

now you're in a holding pattern yeah  
it's like it so now you're stuck in that

311

00:25:46,340 --> 00:25:52,510

middle seat for a little bit longer and  
with these systems that should be if not

312

00:25:52,510 --> 00:25:56,720  
eliminated minimized yeah I think  
anybody who's been on the flight has had

313

00:25:56,720 --> 00:26:00,200  
that experience you're right towards the  
end you're getting to descend and then

314

00:26:00,200 --> 00:26:03,950  
you just circle the airport because  
you're just waiting for your turn and

315

00:26:03,950 --> 00:26:08,539  
you're kind of like really why are we  
doing this yeah but this is the things

316

00:26:08,539 --> 00:26:11,929  
that like some of the research that  
NASA's working on is to minimize that

317

00:26:11,929 --> 00:26:15,590  
and I know when you talk to anybody in  
aeronautics at NASA they always love to

318

00:26:15,590 --> 00:26:18,200  
say  
NASA's with you and you fly and it is a

319

00:26:18,200 --> 00:26:21,620  
true thing it's like wait it's with you  
and you fly and hopefully making that

320

00:26:21,620 --> 00:26:28,520  
flight shorter and safer you know as you  
as you go about your day yeah and that's

321

00:26:28,520 --> 00:26:34,460

so that's ATD ones's emphasis ATD two adds to that by taking not only the arrival work

322

00:26:34,460 --> 00:26:38,210

we've completed with one a new account but adding the airport surface

323

00:26:38,210 --> 00:26:41,270

operations and the departure side when you're trying to

324

00:26:41,270 --> 00:26:45,560

you know the part the airport you probably again you've probably been in

325

00:26:45,560 --> 00:26:49,970

an airplane where you're just waiting for what seems like minutes tens of

326

00:26:49,970 --> 00:26:55,760

minutes or more for the runway just to get a runway go taxiing your your turn

327

00:26:55,760 --> 00:26:59,480

and if you're sitting in the terminal you can see the all the planes lining up

328

00:26:59,480 --> 00:27:05,510

for the runway that's that's not very efficient to either and so similar

329

00:27:05,510 --> 00:27:12,200

premise you know one of NASA Aeronautics hallmarks is scheduling okay so applying

330

00:27:12,200 --> 00:27:16,360

scheduling principles for both the airport surface operations as well as

331

00:27:16,360 --> 00:27:23,030

when to take off in order to merge with  
the the aircraft already flying so kind

332

00:27:23,030 --> 00:27:27,590

of think of it as on ramping into the  
highway in the sky figuring out those

333

00:27:27,590 --> 00:27:32,270

schedules and providing the tools to all  
of the operators whether that's FAA in

334

00:27:32,270 --> 00:27:38,330

the tower or FAA air traffic controllers  
or even the airline airlines as they try

335

00:27:38,330 --> 00:27:42,770

and coordinate their gate and ramp  
operations everybody gets that picture

336

00:27:42,770 --> 00:27:47,270

and gets a say on when they you know are  
you ready yes I'm ready the site can we

337

00:27:47,270 --> 00:27:51,890

go now wait one more minute and you'll  
be able to leave without waiting nice

338

00:27:51,890 --> 00:27:57,860

alright so that's ATD two it kind of  
wraps in the arrival side from one as

339

00:27:57,860 --> 00:28:02,750

well as the airport surface and  
departure operations and also kind of

340

00:28:02,750 --> 00:28:06,170

the magic of that is when you're getting  
into a metropolitan area much much like

341

00:28:06,170 --> 00:28:11,480

this San Francisco Bay Area yeah there's  
three major airports that serve they're

342

00:28:11,480 --> 00:28:14,720  
all launching aircraft in the same  
airspace so that that's added

343

00:28:14,720 --> 00:28:20,330  
coordination that's being built now also  
by that NASA schedulers and so looking

344

00:28:20,330 --> 00:28:25,130  
into the future I know you guys are  
already planning on ATD three so the

345

00:28:25,130 --> 00:28:29,450  
trilogy and I'm sure that there's even  
more to come after that so what is the

346

00:28:29,450 --> 00:28:33,620  
future what are you seeing  
yeah well we've actually already

347

00:28:33,620 --> 00:28:39,080  
initiated three three is a more in in  
route airspace so in cruise altitudes

348

00:28:39,080 --> 00:28:43,190  
when weather is moving across the  
country and airplanes are trying to find

349

00:28:43,190 --> 00:28:47,540  
ways to get around that we're focusing  
kind of on the weather rerouting tools right

350

00:28:47,540 --> 00:28:51,170  
now but it's really about traffic flow  
management so three is up and running

351

00:28:51,170 --> 00:28:56,970

also what's in the future you know the  
one two and three you know when we get

352

00:28:56,970 --> 00:29:01,230

one that technologies from one two and  
three out there they're all going to be

353

00:29:01,230 --> 00:29:05,190

contributing to various types of  
efficiencies but then we want to go

354

00:29:05,190 --> 00:29:10,350

beyond that look at more of a larger  
systemic view so not only have though

355

00:29:10,350 --> 00:29:14,910

will those make it out there but  
systemically as you try and go from your

356

00:29:14,910 --> 00:29:19,440

origin airport to your destination  
airport yeah what other attributes of

357

00:29:19,440 --> 00:29:25,680

that system need to be modernized or  
changed to be more efficient alright so

358

00:29:25,680 --> 00:29:30,540

for folks looking for more information I  
know we go [nasa.gov slash aeronautics](https://www.nasa.gov/aeronautics)

359

00:29:30,540 --> 00:29:36,390

and we are on twitter at NASA Ames we're  
using the hashtag NASA Silicon Valley

360

00:29:36,390 --> 00:29:41,520

so if anybody has questions for a Leighton  
or complaints about how to everybody has

361

00:29:41,520 --> 00:29:47,190

suggestions for later on how to make air  
traffic management more efficient we'll

362

00:29:47,190 --> 00:29:49,650

just send him your way and you can fix  
all their problems right

363

00:29:49,650 --> 00:29:55,230

we're always what we're always  
interested in hearing maybe it could be

364

00:29:55,230 --> 00:29:59,370

the foundation for future research  
never know where those new ideas come