1
00:00:22,310 --> 00:00:19,990
hello i'm beth dickey of the nasa

2
00:00:24,310 --> 00:00:22,320
headquarters office of public affairs

3
00:00:26,470 --> 00:00:24,320
welcome to the leading edge where we

4
00:00:28,630 --> 00:00:26,480
take an in-depth look at aeronautics

5
00:00:30,470 --> 00:00:28,640
problems that nasa is working to solve

6
00:00:32,389 --> 00:00:30,480
through its own research initiatives or

7
00:00:34,790 --> 00:00:32,399
in collaboration with others

8
00:00:38,549 --> 00:00:34,800
today's topic is automatic dependent

9
00:00:40,950 --> 00:00:38,559
surveillance broadcast or adsb the next

10
00:00:42,869 --> 00:00:40,960
generation in airborne surveillance and

11
00:00:46,069 --> 00:00:42,879
cockpit avionics

12
00:00:48,229 --> 00:00:46,079
instead of relying on radar adsb uses

13
00:00:50,389 --> 00:00:48,239

global positioning system satellite

14
00:00:52,869 --> 00:00:50,399
information to give pilots and air

15
00:00:55,110 --> 00:00:52,879
traffic controllers highly accurate

16
00:00:57,029 --> 00:00:55,120
traffic data as well as cockpit displays

17
00:00:59,830 --> 00:00:57,039
that update in real time

18
00:01:01,910 --> 00:00:59,840
adsb promises significant improvements

19
00:01:04,710 --> 00:01:01,920
in air transportation system safety

20
00:01:06,789 --> 00:01:04,720
capacity and efficiency through improved

21
00:01:09,510 --> 00:01:06,799
communications among airplanes in the

22
00:01:11,910 --> 00:01:09,520
air and controllers on the ground

23
00:01:13,830 --> 00:01:11,920
nasa was part of government and industry

24
00:01:15,910 --> 00:01:13,840
team led by the federal aviation

25
00:01:18,469 --> 00:01:15,920
administration which brought adsb to

26
00:01:21,910 --> 00:01:18,479
maturity the team earned one of the most

27
00:01:24,149 --> 00:01:21,920
prestigious awards in aviation in 2007

28
00:01:26,789 --> 00:01:24,159
for its efforts to conceptualize develop

29
00:01:28,950 --> 00:01:26,799
and implement adsb an important

30
00:01:31,350 --> 00:01:28,960
component of this work was a series of

31
00:01:33,190 --> 00:01:31,360
field tests with the united parcel

32
00:01:35,510 --> 00:01:33,200
service in louisville kentucky where

33
00:01:37,670 --> 00:01:35,520
nasa demonstrated a new capability

34
00:01:40,230 --> 00:01:37,680
called airborne precision spacing to

35
00:01:42,469 --> 00:01:40,240
help relieve airport traffic congestion

36
00:01:44,310 --> 00:01:42,479
this is a replica of the coveted collier

37
00:01:46,149 --> 00:01:44,320
trophy you can see the real one in the

38
00:01:48,710 --> 00:01:46,159

national air and space museum here in

39
00:01:51,109 --> 00:01:48,720
washington the collier has been awarded

40
00:01:52,950 --> 00:01:51,119
by the national aeronautics association

41
00:01:54,630 --> 00:01:52,960
since 1911.

42
00:01:56,469 --> 00:01:54,640
many of america's great aerospace

43
00:01:58,870 --> 00:01:56,479
pioneers have received it including

44
00:02:00,789 --> 00:01:58,880
orville wright and neil armstrong it

45
00:02:03,109 --> 00:02:00,799
calls attention to great achievements in

46
00:02:06,069 --> 00:02:03,119
improving the performance efficiency and

47
00:02:09,669 --> 00:02:06,079
safety of air and space vehicles this is

48
00:02:10,949 --> 00:02:09,679
the 21st collier in nasa's collection so

49
00:02:12,390 --> 00:02:10,959
let's get to our discussion of the

50
00:02:14,229 --> 00:02:12,400
award-winning work

51
00:02:17,750 --> 00:02:14,239
today's arrival procedures are often

52
00:02:20,470 --> 00:02:17,760
very noisy dirty and inefficient nasa's

53
00:02:22,470 --> 00:02:20,480
focus was on new automation for air and

54
00:02:24,710 --> 00:02:22,480
ground that not only helps relieve

55
00:02:26,790 --> 00:02:24,720
airport congestion but also increases

56
00:02:28,229 --> 00:02:26,800
efficiency and flexibility in air

57
00:02:30,550 --> 00:02:28,239
traffic management

58
00:02:33,110 --> 00:02:30,560
saves fuel and reduces noise and

59
00:02:36,309 --> 00:02:33,120
emissions one such capability which is

60
00:02:39,110 --> 00:02:36,319
part of adsb is airborne precision

61
00:02:41,509 --> 00:02:39,120
spacing let's learn more about that

62
00:02:44,790 --> 00:02:41,519
new airborne capabilities will also help

63
00:02:47,030 --> 00:02:44,800

the airport congestion problem

64
00:02:49,430 --> 00:02:47,040
high throughput at airports depends in

65
00:02:52,229 --> 00:02:49,440
part on achieving optimal spacing

66
00:02:54,309 --> 00:02:52,239
between landing aircraft

67
00:02:56,710 --> 00:02:54,319
in a new concept called airborne

68
00:02:59,110 --> 00:02:56,720
precision spacing the air traffic

69
00:03:01,430 --> 00:02:59,120
controller responsible for maximizing

70
00:03:04,070 --> 00:03:01,440
the landing rate designates a lead

71
00:03:05,430 --> 00:03:04,080
aircraft for each capable aircraft to

72
00:03:07,190 --> 00:03:05,440
follow

73
00:03:09,670 --> 00:03:07,200
and a target time interval to be

74
00:03:11,910 --> 00:03:09,680
achieved at or near the runway threshold

75
00:03:14,149 --> 00:03:11,920
behind the lead

76
00:03:16,149 --> 00:03:14,159
with the air traffic controllers spacing

77
00:03:18,949 --> 00:03:16,159
goal for these two aircraft now

78
00:03:20,070 --> 00:03:18,959
established pilots of the aircraft then

79
00:03:22,470 --> 00:03:20,080
take over

80
00:03:24,630 --> 00:03:22,480
using specific maneuvers and precise

81
00:03:27,110 --> 00:03:24,640
speed control to accomplish the

82
00:03:31,190 --> 00:03:27,120
controller's assignments with little to

83
00:03:33,830 --> 00:03:31,200
no further communication necessary

84
00:03:35,589 --> 00:03:33,840
using on-board computer path guidance

85
00:03:37,830 --> 00:03:35,599
pilots will maneuver their aircraft

86
00:03:40,949 --> 00:03:37,840
within air traffic controller defined

87
00:03:42,550 --> 00:03:40,959
limits to close large unnecessary gaps

88
00:03:44,869 --> 00:03:42,560

in the arrival stream

89
00:03:47,030 --> 00:03:44,879
or to create room if needed for aircraft

90
00:03:49,830 --> 00:03:47,040
that are resequenced for arrival or

91
00:03:53,030 --> 00:03:49,840
waiting to take off

92
00:03:55,270 --> 00:03:53,040
then using computer speed guidance

93
00:03:56,710 --> 00:03:55,280
pilots will make precise adjustments in

94
00:03:59,670 --> 00:03:56,720
speed

95
00:04:02,070 --> 00:03:59,680
to accurately merge behind aircraft

96
00:04:04,229 --> 00:04:02,080
arriving from other directions and to

97
00:04:06,070 --> 00:04:04,239
fine-tune the spacing as they approach

98
00:04:10,229 --> 00:04:06,080
the runway

99
00:04:12,830 --> 00:04:10,239
threshold at precisely the controller's

100
00:04:16,069 --> 00:04:12,840
desired interval after the preceding

101
00:04:18,390 --> 00:04:16,079
aircraft in addition the system easily

102
00:04:20,789 --> 00:04:18,400
accommodates the safe spacing variations

103
00:04:25,670 --> 00:04:20,799
required for aircraft pairs with

104
00:04:30,469 --> 00:04:27,430
even though the aircraft is now under

105
00:04:32,310 --> 00:04:30,479
positive ground control for separation

106
00:04:34,310 --> 00:04:32,320
this new procedure allows the air

107
00:04:36,870 --> 00:04:34,320
traffic controller to use the pilot's

108
00:04:39,430 --> 00:04:36,880
ability of precision flying to help

109
00:04:41,749 --> 00:04:39,440
increase arrival throughput and minimize

110
00:04:44,790 --> 00:04:41,759
delays for all aircraft assigned to that

111
00:04:49,270 --> 00:04:47,110
by using this new aircraft capability of

112
00:04:51,510 --> 00:04:49,280
airborne precision spacing

113
00:04:53,270 --> 00:04:51,520

controllers at smaller airports will be

114
00:04:55,590 --> 00:04:53,280
able to safely handle

115
00:04:57,510 --> 00:04:55,600
increased traffic demand without the

116
00:05:00,790 --> 00:04:57,520
need to expand their ground-based air

117
00:05:02,710 --> 00:05:00,800
traffic control systems

118
00:05:05,189 --> 00:05:02,720
the radar technology used to track

119
00:05:07,270 --> 00:05:05,199
airplanes hasn't changed much in 60

120
00:05:10,310 --> 00:05:07,280
years but air traffic has increased

121
00:05:12,390 --> 00:05:10,320
significantly the resulting congestion

122
00:05:14,710 --> 00:05:12,400
in the skies poses inconveniences for

123
00:05:17,029 --> 00:05:14,720
air travelers and special challenges for

124
00:05:18,790 --> 00:05:17,039
air traffic controllers a new tracking

125
00:05:20,950 --> 00:05:18,800
technology is needed to support the

126
00:05:23,749 --> 00:05:20,960
volume of operations projected in the

127
00:05:26,870 --> 00:05:23,759
21st century with me to discuss the

128
00:05:28,230 --> 00:05:26,880
challenges and the benefits of adsb are

129
00:05:30,310 --> 00:05:28,240
robert novia

130
00:05:32,390 --> 00:05:30,320
operations manager with the faa's

131
00:05:34,710 --> 00:05:32,400
enroute and oceanic services unit

132
00:05:36,790 --> 00:05:34,720
currently leading the operations support

133
00:05:39,270 --> 00:05:36,800
team for the surveillance and broadcast

134
00:05:41,749 --> 00:05:39,280
program services office and captain bob

135
00:05:43,990 --> 00:05:41,759
hill a retired manager of the advanced

136
00:05:45,830 --> 00:05:44,000
flight systems department at united

137
00:05:47,430 --> 00:05:45,840
parcel service

138
00:05:48,629 --> 00:05:47,440

this question i'm going to start with

139
00:05:50,070 --> 00:05:48,639
you robert

140
00:05:52,469 --> 00:05:50,080
can you talk to us a little bit about

141
00:05:54,870 --> 00:05:52,479
how arrival control is done today and

142
00:05:56,230 --> 00:05:54,880
how it's being improved sure and first

143
00:05:58,710 --> 00:05:56,240
of all thank you beth it's a pleasure to

144
00:06:00,469 --> 00:05:58,720
be with nasa today

145
00:06:02,150 --> 00:06:00,479
managing arrivals

146
00:06:04,790 --> 00:06:02,160
into a major terminal area is somewhat

147
00:06:06,469 --> 00:06:04,800
situational it depends on the the size

148
00:06:09,270 --> 00:06:06,479
of the terminal area and the traffic

149
00:06:10,870 --> 00:06:09,280
load but by and large we we descend we

150
00:06:12,390 --> 00:06:10,880
initially descend aircraft on published

151
00:06:13,909 --> 00:06:12,400
arrival procedures

152
00:06:15,590 --> 00:06:13,919
and during the course of doing that

153
00:06:17,350 --> 00:06:15,600
there are normally more than one

154
00:06:19,909 --> 00:06:17,360
transition to those arrival procedures

155
00:06:22,550 --> 00:06:19,919
so by that we mean that there could be

156
00:06:24,390 --> 00:06:22,560
two or three or even four streams of

157
00:06:27,510 --> 00:06:24,400
traffic that the air traffic controller

158
00:06:28,710 --> 00:06:27,520
has to blend into one sequence over a

159
00:06:31,350 --> 00:06:28,720
particular

160
00:06:32,150 --> 00:06:31,360
fix or location going into the terminal

161
00:06:34,230 --> 00:06:32,160
area

162
00:06:36,150 --> 00:06:34,240
and normally in order to do that the

163
00:06:38,950 --> 00:06:36,160

normal course of business is that

164
00:06:40,950 --> 00:06:38,960
depending on how how busy the the

165
00:06:43,590 --> 00:06:40,960
circumstances are the controller will

166
00:06:46,790 --> 00:06:43,600
have to issue radar vectors or heading

167
00:06:49,830 --> 00:06:46,800
changes speed changes altitude changes

168
00:06:50,870 --> 00:06:49,840
all at increasingly lower altitudes

169
00:06:53,029 --> 00:06:50,880
which

170
00:06:55,110 --> 00:06:53,039
magnifies the inefficiency to the

171
00:06:57,830 --> 00:06:55,120
operator in doing so

172
00:06:59,990 --> 00:06:57,840
so the the key here is to stage these

173
00:07:02,550 --> 00:07:00,000
aircraft more efficiently

174
00:07:05,029 --> 00:07:02,560
to make earlier uh trajectory

175
00:07:07,510 --> 00:07:05,039
modifications and and by doing so they

176
00:07:10,070 --> 00:07:07,520
can be smaller maybe just uh minor speed

177
00:07:11,749 --> 00:07:10,080
adjustments so when the controller gets

178
00:07:14,150 --> 00:07:11,759
these these aircraft on these different

179
00:07:16,390 --> 00:07:14,160
streams there's there's less to do to

180
00:07:18,710 --> 00:07:16,400
space them into the terminal area

181
00:07:20,150 --> 00:07:18,720
now we have a tape that was prepared by

182
00:07:22,309 --> 00:07:20,160
one of the partners in the collier

183
00:07:23,589 --> 00:07:22,319
trophy work can we roll that tape and

184
00:07:29,029 --> 00:07:23,599
and can you explain to us what we're

185
00:07:35,110 --> 00:07:32,870
okay so so here we have uh

186
00:07:37,270 --> 00:07:35,120
it shows two streams blending into one

187
00:07:39,270 --> 00:07:37,280
so here's what i meant by uh different

188
00:07:41,909 --> 00:07:39,280

transitions in an arrival procedure

189
00:07:43,909 --> 00:07:41,919
where the controller has to blend those

190
00:07:46,230 --> 00:07:43,919
traffic streams now keep in mind this is

191
00:07:47,830 --> 00:07:46,240
a rather sterile environment but you can

192
00:07:50,309 --> 00:07:47,840
see that uh

193
00:07:52,869 --> 00:07:50,319
the the last aircraft in that sequence

194
00:07:55,189 --> 00:07:52,879
is being radar vectored out or a heading

195
00:07:57,189 --> 00:07:55,199
change in order to get appropriate

196
00:07:59,670 --> 00:07:57,199
spacing i see a lot of dollar signs

197
00:08:01,189 --> 00:07:59,680
going out the tail end

198
00:08:03,270 --> 00:08:01,199
yeah so that's our cute way of showing

199
00:08:06,869 --> 00:08:03,280
that that right at that point now we're

200
00:08:09,909 --> 00:08:06,879
we're imposing a cost on the operator to

201
00:08:12,950 --> 00:08:09,919
to get the spacing that we need

202
00:08:15,990 --> 00:08:12,960
now here here is a potentially future

203
00:08:18,390 --> 00:08:16,000
environment where because of minor speed

204
00:08:22,150 --> 00:08:18,400
adjustments we made earlier on the

205
00:08:24,469 --> 00:08:22,160
aircraft would nicely fit into a gap

206
00:08:26,550 --> 00:08:24,479
and this kind of mitigates that spacing

207
00:08:28,629 --> 00:08:26,560
problem the controller doesn't have to

208
00:08:30,869 --> 00:08:28,639
to issue what we call

209
00:08:32,469 --> 00:08:30,879
tactical measures and maneuvers to space

210
00:08:34,630 --> 00:08:32,479
the aircraft and they can just fall

211
00:08:36,870 --> 00:08:34,640
right into the stream

212
00:08:39,029 --> 00:08:36,880
now this is a tough situation obviously

213
00:08:41,029 --> 00:08:39,039

for operators bob how does this sort of

214
00:08:43,509 --> 00:08:41,039
air traffic control situation

215
00:08:45,190 --> 00:08:43,519
affect ups well thank you beth and and

216
00:08:46,870 --> 00:08:45,200
on behalf of the entire industry i'd

217
00:08:48,070 --> 00:08:46,880
like to thank nasa for all their work

218
00:08:49,829 --> 00:08:48,080
that they're doing

219
00:08:52,870 --> 00:08:49,839
in in new technologies that will allow

220
00:08:54,630 --> 00:08:52,880
us to modernize uh the aviation everyone

221
00:08:56,389 --> 00:08:54,640
knows how important it is for next-gen

222
00:08:58,230 --> 00:08:56,399
to succeed and if it wasn't for the

223
00:09:00,070 --> 00:08:58,240
fundamental and practical research that

224
00:09:02,389 --> 00:09:00,080
nasa has done we wouldn't be in the

225
00:09:04,070 --> 00:09:02,399
position we are today to be able to to

226
00:09:07,829 --> 00:09:04,080
modernize and and two of those

227
00:09:10,630 --> 00:09:07,839
technologies are adsb and airborne

228
00:09:13,030 --> 00:09:10,640
precision spacing as far as ups is

229
00:09:15,509 --> 00:09:13,040
concerned ups has the same problem with

230
00:09:18,070 --> 00:09:15,519
this major hubs as any other carrier

231
00:09:20,710 --> 00:09:18,080
congestion and delays the hub can really

232
00:09:21,910 --> 00:09:20,720
harm the operation

233
00:09:24,070 --> 00:09:21,920
many of you probably aren't familiar

234
00:09:26,790 --> 00:09:24,080
with the ups operation or package

235
00:09:29,030 --> 00:09:26,800
delivery operation but all the aircraft

236
00:09:30,790 --> 00:09:29,040
come into the hub with the packages they

237
00:09:32,949 --> 00:09:30,800
all have to land the packages are then

238
00:09:35,430 --> 00:09:32,959

sorted put on aircraft and they depart

239
00:09:37,670 --> 00:09:35,440
back out louisville is a particularly

240
00:09:41,269 --> 00:09:37,680
important hub for ups because it's the

241
00:09:43,030 --> 00:09:41,279
only hub that ups has that all of the uh

242
00:09:44,389 --> 00:09:43,040
aircraft from all the world so packages

243
00:09:45,990 --> 00:09:44,399
from all around the world come into

244
00:09:48,389 --> 00:09:46,000
louisville they're sorted and go back

245
00:09:49,990 --> 00:09:48,399
out so you can see that if any of those

246
00:09:51,430 --> 00:09:50,000
aircraft are delayed the last few

247
00:09:52,949 --> 00:09:51,440
aircraft that are delayed it delays the

248
00:09:54,870 --> 00:09:52,959
whole operation and that could

249
00:09:56,949 --> 00:09:54,880
significantly affect the whole ups

250
00:09:59,269 --> 00:09:56,959
operation it could result in delayed

251
00:10:01,509 --> 00:09:59,279
packages all around the world

252
00:10:04,310 --> 00:10:01,519
another major problem that ups is always

253
00:10:05,670 --> 00:10:04,320
looking at is is the environment how can

254
00:10:07,990 --> 00:10:05,680
we help the environment i'm sure you've

255
00:10:10,069 --> 00:10:08,000
seen some of the articles about what ups

256
00:10:12,389 --> 00:10:10,079
has done to modernize vehicles and all

257
00:10:15,829 --> 00:10:12,399
sorts of different alternatives to make

258
00:10:17,350 --> 00:10:15,839
ground vehicles more uh effective uh

259
00:10:20,230 --> 00:10:17,360
less

260
00:10:22,310 --> 00:10:20,240
emissions

261
00:10:24,790 --> 00:10:22,320
we have that same desire in the airline

262
00:10:26,389 --> 00:10:24,800
part of ups and a particular concern to

263
00:10:28,310 --> 00:10:26,399

ups is noise

264
00:10:29,910 --> 00:10:28,320
because most of these operations are at

265
00:10:31,670 --> 00:10:29,920
night we want to be a good neighbor and

266
00:10:33,350 --> 00:10:31,680
we really want to reduce our noise one

267
00:10:36,949 --> 00:10:33,360
example of that is

268
00:10:38,870 --> 00:10:36,959
that ups was the first airline to comply

269
00:10:40,710 --> 00:10:38,880
with the lower noise standards for

270
00:10:42,310 --> 00:10:40,720
engine noise and

271
00:10:44,230 --> 00:10:42,320
all of our aircraft were completed well

272
00:10:45,110 --> 00:10:44,240
ahead of the deadline we're very proud

273
00:10:47,030 --> 00:10:45,120
of that

274
00:10:49,829 --> 00:10:47,040
so we have problems with scheduling and

275
00:10:51,829 --> 00:10:49,839
noise and fuel efficiency what did ups

276
00:10:55,030 --> 00:10:51,839
do to try to solve those problems

277
00:10:58,069 --> 00:10:55,040
well ups uh has been involved with adsb

278
00:11:00,230 --> 00:10:58,079
like nasa from probably the mid 90s on

279
00:11:02,150 --> 00:11:00,240
and so there's a lot of work and and ups

280
00:11:04,470 --> 00:11:02,160
identified this as a potential

281
00:11:06,790 --> 00:11:04,480
technology that could really uh increase

282
00:11:09,350 --> 00:11:06,800
the efficiency and operations at our

283
00:11:10,069 --> 00:11:09,360
hubs and throughout the nation

284
00:11:15,269 --> 00:11:10,079
the

285
00:11:17,190 --> 00:11:15,279
operational evaluations we actually put

286
00:11:18,310 --> 00:11:17,200
a number of aircraft in some cases 20 or

287
00:11:20,630 --> 00:11:18,320
25

288
00:11:22,230 --> 00:11:20,640

uh into the air at one time to to test

289
00:11:26,150 --> 00:11:22,240
some of this technology and those were

290
00:11:28,150 --> 00:11:26,160
done in 1999 and 2000. the one in 2000

291
00:11:29,590 --> 00:11:28,160
actually nasa participated with an

292
00:11:30,389 --> 00:11:29,600
aircraft and there were a number of

293
00:11:33,590 --> 00:11:30,399
other

294
00:11:35,829 --> 00:11:33,600
participants that actually put

295
00:11:37,509 --> 00:11:35,839
the airborne precision spacing on the

296
00:11:39,350 --> 00:11:37,519
aircraft and demonstrated that it was a

297
00:11:42,069 --> 00:11:39,360
viable technology

298
00:11:44,150 --> 00:11:42,079
although ups didn't really have a plan

299
00:11:47,670 --> 00:11:44,160
to for one particular application it did

300
00:11:50,069 --> 00:11:47,680
decide to uh further uh explore this by

301
00:11:52,949 --> 00:11:50,079
putting adsb on all of its seven fives

302
00:11:55,910 --> 00:11:52,959
and seven sixes in the early 90s

303
00:11:57,990 --> 00:11:55,920
so at the same time another project that

304
00:12:00,710 --> 00:11:58,000
nasa was involved with was continuous

305
00:12:02,310 --> 00:12:00,720
decent arrivals the concept here is

306
00:12:03,350 --> 00:12:02,320
instead of all the vectoring and

307
00:12:06,629 --> 00:12:03,360
altitude

308
00:12:08,389 --> 00:12:06,639
robert talked about what we want to do

309
00:12:10,710 --> 00:12:08,399
is we want to have the aircraft descend

310
00:12:12,230 --> 00:12:10,720
from their cruise altitude on an optimal

311
00:12:14,230 --> 00:12:12,240
path both both horizontally and

312
00:12:16,150 --> 00:12:14,240
vertically to the runway

313
00:12:17,750 --> 00:12:16,160

and there had been talk about that for a

314
00:12:21,670 --> 00:12:17,760
long time nobody had really tested the

315
00:12:23,110 --> 00:12:21,680
viability of that so in 2002 2004 there

316
00:12:25,190 --> 00:12:23,120
were some extensive tests that were done

317
00:12:27,509 --> 00:12:25,200
with ups aircraft and of course nasa was

318
00:12:30,230 --> 00:12:27,519
involved in testing this concept we do

319
00:12:32,790 --> 00:12:30,240
have a slide here that shows the results

320
00:12:35,190 --> 00:12:32,800
of that that test

321
00:12:36,870 --> 00:12:35,200
on on the top left you'll see

322
00:12:40,150 --> 00:12:36,880
basically when we were doing these

323
00:12:42,629 --> 00:12:40,160
trials how compact the flight paths were

324
00:12:43,910 --> 00:12:42,639
and and uh on the bottom one you can see

325
00:12:45,750 --> 00:12:43,920
that they're all over the place that's

326
00:12:47,670 --> 00:12:45,760
the difference between when you can take

327
00:12:49,670 --> 00:12:47,680
the airplane from altitude put them on a

328
00:12:51,350 --> 00:12:49,680
optimal path rather than all the

329
00:12:54,069 --> 00:12:51,360
vectoring and and other things that

330
00:12:55,670 --> 00:12:54,079
occur in a modern environment but the

331
00:12:58,310 --> 00:12:55,680
real surprise was with some of the stuff

332
00:13:00,470 --> 00:12:58,320
on the right there was a 30 reduction in

333
00:13:02,150 --> 00:13:00,480
noise and a greater than 30 reduction in

334
00:13:03,670 --> 00:13:02,160
emissions that's that's an enormous

335
00:13:05,190 --> 00:13:03,680
reduction when we're talking about a lot

336
00:13:07,110 --> 00:13:05,200
of the projects that are going on people

337
00:13:08,389 --> 00:13:07,120
are looking for one two

338
00:13:09,750 --> 00:13:08,399

they think they do really well if they

339
00:13:11,670 --> 00:13:09,760
get five percent but thirty percent

340
00:13:13,110 --> 00:13:11,680
reduction is just extraordinary and

341
00:13:15,110 --> 00:13:13,120
that's why everybody in the industry is

342
00:13:16,949 --> 00:13:15,120
very excited about getting this uh these

343
00:13:19,509 --> 00:13:16,959
ideas out there and and they are being

344
00:13:20,550 --> 00:13:19,519
used to a limited extent around around

345
00:13:22,710 --> 00:13:20,560
the globe

346
00:13:23,990 --> 00:13:22,720
and of course the operators like it also

347
00:13:26,550 --> 00:13:24,000
because there is a fuel savings

348
00:13:29,110 --> 00:13:26,560
identified there what's the

349
00:13:31,030 --> 00:13:29,120
geographic area that's covered by those

350
00:13:32,790 --> 00:13:31,040
the colored parts of that the edge of

351
00:13:34,470 --> 00:13:32,800
the slides are about 30 but where you

352
00:13:35,910 --> 00:13:34,480
see the the full colored tracks and

353
00:13:38,310 --> 00:13:35,920
everything that's about the last 10

354
00:13:40,949 --> 00:13:38,320
miles of the flight so 30 miles down to

355
00:13:44,310 --> 00:13:40,959
10 miles and and did you get any

356
00:13:46,310 --> 00:13:44,320
feedback from airport neighbors about

357
00:13:48,550 --> 00:13:46,320
whether they experienced any reduced

358
00:13:50,230 --> 00:13:48,560
noise yes it was it was noticeable and

359
00:13:51,829 --> 00:13:50,240
we did get some good compliments on that

360
00:13:52,550 --> 00:13:51,839
one of the funny things that happened

361
00:13:54,310 --> 00:13:52,560
was

362
00:13:56,949 --> 00:13:54,320
we were looking at some of the results

363
00:13:58,710 --> 00:13:56,959

and we saw some noise spikes in in some

364
00:14:00,550 --> 00:13:58,720
of the data that was taken at one of the

365
00:14:02,230 --> 00:14:00,560
sensors and it turned out it was a

366
00:14:04,470 --> 00:14:02,240
barking dog the barking dog was much

367
00:14:06,150 --> 00:14:04,480
louder than the aircraft

368
00:14:07,990 --> 00:14:06,160
that's pretty good

369
00:14:10,629 --> 00:14:08,000
uh you you um

370
00:14:12,949 --> 00:14:10,639
you had ended up having aircraft farther

371
00:14:14,629 --> 00:14:12,959
apart because of this is that is that

372
00:14:16,310 --> 00:14:14,639
right that's correct that was the only

373
00:14:17,670 --> 00:14:16,320
negative part of this whole thing and

374
00:14:19,990 --> 00:14:17,680
that's why it hasn't been more widely

375
00:14:21,910 --> 00:14:20,000
implemented at this point in time to get

376
00:14:23,829 --> 00:14:21,920
those aircraft so that they can have the

377
00:14:25,430 --> 00:14:23,839
freedom to be able to fly that optimal

378
00:14:26,790 --> 00:14:25,440
path meant we had to put the aircraft

379
00:14:28,629 --> 00:14:26,800
further apart if they're too close

380
00:14:29,910 --> 00:14:28,639
together the controller has to intervene

381
00:14:31,430 --> 00:14:29,920
and the controller has to take the

382
00:14:33,430 --> 00:14:31,440
aircraft off that

383
00:14:34,870 --> 00:14:33,440
optimal path so by putting the aircraft

384
00:14:38,629 --> 00:14:34,880
further apart

385
00:14:40,629 --> 00:14:38,639
we were able to to do this particular

386
00:14:42,790 --> 00:14:40,639
event so

387
00:14:44,870 --> 00:14:42,800
having them farther apart is a problem

388
00:14:46,550 --> 00:14:44,880

because you've got a schedule to meet

389
00:14:48,470 --> 00:14:46,560
and packages that have to get that are

390
00:14:50,389 --> 00:14:48,480
there destinations and customers that

391
00:14:52,230 --> 00:14:50,399
have to be pleased so

392
00:14:53,750 --> 00:14:52,240
how did you how did you work on that how

393
00:14:55,590 --> 00:14:53,760
did you solve that that's that's that's

394
00:14:57,269 --> 00:14:55,600
the problem and as i said the trials

395
00:14:58,949 --> 00:14:57,279
that are going on today they're only in

396
00:15:00,310 --> 00:14:58,959
very low density so that when you put

397
00:15:01,910 --> 00:15:00,320
the aircraft further apart you don't

398
00:15:04,470 --> 00:15:01,920
take a real penalty but if you try to do

399
00:15:06,470 --> 00:15:04,480
this in a major hub when the uh

400
00:15:08,790 --> 00:15:06,480
the capacity is at the same level as the

401
00:15:11,430 --> 00:15:08,800
demand you really have to you can't do

402
00:15:12,949 --> 00:15:11,440
it so we we looked at

403
00:15:14,230 --> 00:15:12,959
putting these two two technologies

404
00:15:17,110 --> 00:15:14,240
together those two projects i just

405
00:15:20,550 --> 00:15:17,120
talked about and and adding um

406
00:15:22,310 --> 00:15:20,560
airborne precision spacing to the

407
00:15:23,509 --> 00:15:22,320
to the aircraft now that's the adsb

408
00:15:25,670 --> 00:15:23,519
application

409
00:15:27,990 --> 00:15:25,680
the cda constant decent arrival does not

410
00:15:31,110 --> 00:15:28,000
require adsb but to get it so it's

411
00:15:33,509 --> 00:15:31,120
viable and in very dense operations you

412
00:15:35,509 --> 00:15:33,519
really need to add the uh the airborne

413
00:15:37,910 --> 00:15:35,519

precision spacing so we put these two

414
00:15:39,509 --> 00:15:37,920
technologies together and and and we've

415
00:15:41,430 --> 00:15:39,519
run a number of trials on that and it

416
00:15:43,350 --> 00:15:41,440
works wonderfully it really does it is

417
00:15:45,990 --> 00:15:43,360
the solution for for the future as far

418
00:15:47,749 --> 00:15:46,000
as how we can get all these benefits i

419
00:15:48,550 --> 00:15:47,759
think that for those scientists out

420
00:15:50,389 --> 00:15:48,560
there

421
00:15:52,470 --> 00:15:50,399
the idea is today is basically a random

422
00:15:55,110 --> 00:15:52,480
system though it's an open loop system

423
00:15:56,710 --> 00:15:55,120
the controller does some control loop

424
00:15:58,629 --> 00:15:56,720
but but it's it's really not very

425
00:16:00,230 --> 00:15:58,639
precise and it's only at the end to be

426
00:16:01,910 --> 00:16:00,240
able to get this so it works completely

427
00:16:03,910 --> 00:16:01,920
what we need to do is schedule the

428
00:16:05,829 --> 00:16:03,920
aircraft a couple hundred miles from the

429
00:16:08,870 --> 00:16:05,839
airport and then we control that

430
00:16:11,590 --> 00:16:08,880
schedule using the uh

431
00:16:13,030 --> 00:16:11,600
aircraft precision spacing so that way

432
00:16:15,269 --> 00:16:13,040
the aircraft space all the way to the

433
00:16:17,030 --> 00:16:15,279
runway and we're able to do this on a

434
00:16:18,310 --> 00:16:17,040
very repeatable basis and one of the

435
00:16:19,670 --> 00:16:18,320
things you really get out of this is it

436
00:16:22,629 --> 00:16:19,680
turns out that you can do this in all

437
00:16:24,310 --> 00:16:22,639
weather today the delays go down when

438
00:16:26,069 --> 00:16:24,320

the weather is nice because the aircraft

439
00:16:28,470 --> 00:16:26,079
get closer together there's pilot

440
00:16:31,030 --> 00:16:28,480
involvement in the process when we're in

441
00:16:33,829 --> 00:16:31,040
bad weather we can't do that so we end

442
00:16:36,069 --> 00:16:33,839
up losing capacity when we do this it

443
00:16:37,990 --> 00:16:36,079
works in all weather conditions it's

444
00:16:39,670 --> 00:16:38,000
it's wonderful now you you've brought us

445
00:16:41,430 --> 00:16:39,680
some animation to show how this works is

446
00:16:43,430 --> 00:16:41,440
that right yes let's go ahead and show

447
00:16:46,550 --> 00:16:43,440
what it would look like if if we had all

448
00:16:48,949 --> 00:16:46,560
the aircraft in a major hub fully

449
00:16:51,189 --> 00:16:48,959
uh implemented you'll see that the the

450
00:16:52,629 --> 00:16:51,199
red the red bars in there are actually

451
00:16:55,509 --> 00:16:52,639
slots that the aircraft take in the

452
00:16:57,110 --> 00:16:55,519
schedule the yellow bars are the ones

453
00:16:58,629 --> 00:16:57,120
that there's a slot that's going to be

454
00:16:59,910 --> 00:16:58,639
used by an aircraft coming from another

455
00:17:01,829 --> 00:16:59,920
direction in other words we're going to

456
00:17:04,230 --> 00:17:01,839
have a merge in the process

457
00:17:05,990 --> 00:17:04,240
and the green slots are unused in this

458
00:17:07,669 --> 00:17:06,000
process what we saw was the inbounds

459
00:17:09,429 --> 00:17:07,679
from louisville to louisville from the

460
00:17:11,909 --> 00:17:09,439
east and now we're seeing them from the

461
00:17:13,669 --> 00:17:11,919
west and you can see how how precise all

462
00:17:15,270 --> 00:17:13,679
this looks and it's and there's no none

463
00:17:16,949 --> 00:17:15,280

of that vectoring you see when you're

464
00:17:18,549 --> 00:17:16,959
out as a passenger day and the aircraft

465
00:17:19,590 --> 00:17:18,559
are flying back and forth in front of

466
00:17:21,270 --> 00:17:19,600
the airport

467
00:17:23,909 --> 00:17:21,280
all right so let's scale that out a

468
00:17:26,949 --> 00:17:23,919
little bit for robert what what is the

469
00:17:29,110 --> 00:17:26,959
status of implementation of adsb and

470
00:17:30,870 --> 00:17:29,120
how is the faa integrating with all of

471
00:17:32,390 --> 00:17:30,880
the different government and industry

472
00:17:34,070 --> 00:17:32,400
organizations that

473
00:17:36,950 --> 00:17:34,080
are involved in this

474
00:17:40,470 --> 00:17:36,960
so so the adsp program office under the

475
00:17:42,630 --> 00:17:40,480
faa has been around since early 2006 and

476
00:17:45,270 --> 00:17:42,640
we've really accomplished a remarkable

477
00:17:47,830 --> 00:17:45,280
amount in that short period of time we

478
00:17:50,470 --> 00:17:47,840
we are aggressively deploying the ground

479
00:17:52,310 --> 00:17:50,480
infrastructure putting adsb radio

480
00:17:54,070 --> 00:17:52,320
stations throughout the nas it's going

481
00:17:56,150 --> 00:17:54,080
to take some 800

482
00:17:57,430 --> 00:17:56,160
radio stations to cover

483
00:18:00,470 --> 00:17:57,440
all the airspace that's currently

484
00:18:02,470 --> 00:18:00,480
covered by radar today and we are also

485
00:18:04,230 --> 00:18:02,480
part of the program's baseline includes

486
00:18:06,070 --> 00:18:04,240
the gulf of mexico so we'll have

487
00:18:08,950 --> 00:18:06,080
surveillance for houston center across

488
00:18:10,710 --> 00:18:08,960

the gulf of mexico

489
00:18:13,669 --> 00:18:10,720
we have we have four key sites that

490
00:18:15,590 --> 00:18:13,679
we're gonna we hope to get implemented

491
00:18:17,350 --> 00:18:15,600
this year within the next six months

492
00:18:19,350 --> 00:18:17,360
they are louisville kentucky

493
00:18:21,590 --> 00:18:19,360
philadelphia

494
00:18:23,029 --> 00:18:21,600
houston center's gulf of mexico and

495
00:18:24,870 --> 00:18:23,039
juneau alaska

496
00:18:26,470 --> 00:18:24,880
each of those sites represents a

497
00:18:28,390 --> 00:18:26,480
different automation platform within the

498
00:18:31,270 --> 00:18:28,400
faa so we're demonstrating

499
00:18:33,190 --> 00:18:31,280
that adsb can be integrated into the

500
00:18:35,430 --> 00:18:33,200
national airspace system for the

501
00:18:37,590 --> 00:18:35,440
purposes of providing air traffic

502
00:18:38,390 --> 00:18:37,600
services so the the controller now will

503
00:18:40,710 --> 00:18:38,400
see

504
00:18:44,789 --> 00:18:40,720
targets that will be partially derived

505
00:18:47,430 --> 00:18:44,799
by adsb and radar we're implementing new

506
00:18:49,190 --> 00:18:47,440
fusion trackers to to integrate

507
00:18:52,549 --> 00:18:49,200
all the surveillance sources

508
00:18:54,150 --> 00:18:52,559
and so by 2013 we expect to have the

509
00:18:56,470 --> 00:18:54,160
entire

510
00:18:58,870 --> 00:18:56,480
ground infrastructure in place all 800

511
00:19:00,630 --> 00:18:58,880
radio stations

512
00:19:02,789 --> 00:19:00,640
great great robert

513
00:19:05,110 --> 00:19:02,799

bob thanks for being here to share with

514
00:19:07,270 --> 00:19:05,120
us today we can we can see now why a new

515
00:19:09,029 --> 00:19:07,280
tracking technology is necessary to

516
00:19:11,029 --> 00:19:09,039
support this volume of operations that

517
00:19:13,029 --> 00:19:11,039
we'll have in the 21st century in a

518
00:19:14,870 --> 00:19:13,039
moment we'll take a look at airborne

519
00:19:17,750 --> 00:19:14,880
precision spacing and nasa's

520
00:19:19,909 --> 00:19:17,760
contribution to the ups field tests with

521
00:19:22,310 --> 00:19:19,919
two nasa research scientists and our

522
00:19:25,110 --> 00:19:22,320
associate administrator for aeronautics

523
00:19:27,110 --> 00:19:25,120
research jaewon shin but first we want

524
00:19:28,630 --> 00:19:27,120
to give you an opportunity to get better

525
00:19:31,190 --> 00:19:28,640
acquainted with one of our four

526
00:19:36,070 --> 00:19:31,200
aeronautics research centers the langley

527
00:19:39,430 --> 00:19:38,390
aviation pioneer orville wright once

528
00:19:42,070 --> 00:19:39,440
said

529
00:19:44,470 --> 00:19:42,080
no flying machine will ever fly from new

530
00:19:47,110 --> 00:19:44,480
york to paris

531
00:19:49,270 --> 00:19:47,120
now those flights happen every day

532
00:19:51,590 --> 00:19:49,280
people goods and services move around

533
00:19:53,669 --> 00:19:51,600
the globe thanks to nasa langley

534
00:19:55,830 --> 00:19:53,679
aeronautics research

535
00:19:58,549 --> 00:19:55,840
langley engineers and technicians push

536
00:19:59,909 --> 00:19:58,559
the boundaries of flight ever faster and

537
00:20:01,669 --> 00:19:59,919
higher

538
00:20:04,710 --> 00:20:01,679

leading the way in innovation and

539
00:20:07,029 --> 00:20:04,720
technology development

540
00:20:09,750 --> 00:20:07,039
we are key to the nationwide effort to

541
00:20:11,750 --> 00:20:09,760
modernize the skies to meet demands for

542
00:20:14,149 --> 00:20:11,760
increased air travel

543
00:20:16,549 --> 00:20:14,159
we design technologies to make the skies

544
00:20:18,470 --> 00:20:16,559
safer then take them to flight to make

545
00:20:21,909 --> 00:20:18,480
sure they work

546
00:20:24,470 --> 00:20:21,919
and they do every modern aircraft relies

547
00:20:27,669 --> 00:20:24,480
on technology developed over the last 90

548
00:20:29,590 --> 00:20:27,679
years at nasa langley

549
00:20:32,310 --> 00:20:29,600
langley researchers are changing the

550
00:20:35,110 --> 00:20:32,320
shape of aircraft to come too

551
00:20:37,750 --> 00:20:35,120
making them quieter

552
00:20:42,630 --> 00:20:40,470
and greener

553
00:20:45,669 --> 00:20:42,640
we're working to achieve supersonic

554
00:20:51,029 --> 00:20:47,510
and hypersonic breakthroughs with our

555
00:20:55,270 --> 00:20:53,510
nearly every us military aircraft has

556
00:20:56,950 --> 00:20:55,280
been tested in our wind tunnels and

557
00:20:59,669 --> 00:20:56,960
laboratories

558
00:21:01,510 --> 00:20:59,679
and when we go on to the moon and mars

559
00:21:03,909 --> 00:21:01,520
langley aeronautics expertise will

560
00:21:06,310 --> 00:21:03,919
safely lead the way

561
00:21:08,149 --> 00:21:06,320
through earth's atmosphere and those of

562
00:21:11,110 --> 00:21:08,159
other planets

563
00:21:12,950 --> 00:21:11,120

at nasa langley our mission is to uplift

564
00:21:15,669 --> 00:21:12,960
the world through our aeronautics

565
00:21:18,470 --> 00:21:15,679
research and inspire innovations for a

566
00:21:20,630 --> 00:21:18,480
better tomorrow

567
00:21:26,630 --> 00:21:20,640
nasa langley

568
00:21:30,470 --> 00:21:28,230
you're watching the leading edge an

569
00:21:33,190 --> 00:21:30,480
aeronautics research discussion program

570
00:21:34,870 --> 00:21:33,200
brought to you by nasa let me introduce

571
00:21:37,430 --> 00:21:34,880
our associate administrator for

572
00:21:39,029 --> 00:21:37,440
aeronautics research jaiwan shin who

573
00:21:40,950 --> 00:21:39,039
will continue our chat about an

574
00:21:43,029 --> 00:21:40,960
environmentally friendly solution for

575
00:21:45,270 --> 00:21:43,039
air traffic congestion around airports

576
00:21:47,270 --> 00:21:45,280
nasa's airborne precision spacing

577
00:21:50,390 --> 00:21:47,280
research with two of our research

578
00:21:52,549 --> 00:21:50,400
scientists nancy smith and brian varmour

579
00:21:55,029 --> 00:21:52,559
both represent the aeronautics research

580
00:21:58,470 --> 00:21:55,039
mission directorate's airspace systems

581
00:22:01,110 --> 00:21:58,480
program nancy is with the human systems

582
00:22:03,990 --> 00:22:01,120
integration division at nasa's ames

583
00:22:06,789 --> 00:22:04,000
research center in california and brian

584
00:22:08,789 --> 00:22:06,799
is with the crew systems and aviations

585
00:22:11,990 --> 00:22:08,799
ava this is a hard one

586
00:22:14,710 --> 00:22:12,000
aviation operations branch at langley

587
00:22:17,270 --> 00:22:14,720
jay won great thank you beth

588
00:22:18,149 --> 00:22:17,280

nancy and uh brian it's good to see you

589
00:22:20,230 --> 00:22:18,159
again

590
00:22:22,710 --> 00:22:20,240
thank you so much for being with us

591
00:22:25,190 --> 00:22:22,720
today to discuss your research thank you

592
00:22:26,390 --> 00:22:25,200
um i i believe our audience will

593
00:22:29,110 --> 00:22:26,400
appreciate

594
00:22:30,310 --> 00:22:29,120
how important your research is we just

595
00:22:31,830 --> 00:22:30,320
heard from

596
00:22:34,710 --> 00:22:31,840
robert and bob

597
00:22:37,669 --> 00:22:34,720
about what real life problems they are

598
00:22:40,390 --> 00:22:37,679
dealing with and what benefit real life

599
00:22:42,870 --> 00:22:40,400
benefits they have received from nasa

600
00:22:46,070 --> 00:22:42,880
research so without any

601
00:22:48,390 --> 00:22:46,080
further ado let's dive right into it

602
00:22:50,789 --> 00:22:48,400
what kind of uh

603
00:22:52,870 --> 00:22:50,799
let's discuss what kind of a

604
00:22:55,669 --> 00:22:52,880
wonderful research that we've been doing

605
00:22:57,270 --> 00:22:55,679
in particular your research

606
00:23:00,390 --> 00:22:57,280
to begin

607
00:23:02,549 --> 00:23:00,400
i i'm curious how we are

608
00:23:05,190 --> 00:23:02,559
well recognized by

609
00:23:07,270 --> 00:23:05,200
national aeronautics association with

610
00:23:09,510 --> 00:23:07,280
the coliothropy let's talk about that

611
00:23:11,350 --> 00:23:09,520
first okay

612
00:23:13,029 --> 00:23:11,360
well i think um

613
00:23:15,270 --> 00:23:13,039

we were recognized for the collier

614
00:23:17,350 --> 00:23:15,280
trophy because of the our involvement in

615
00:23:18,310 --> 00:23:17,360
the activities that bob was describing

616
00:23:22,870 --> 00:23:18,320
the

617
00:23:24,870 --> 00:23:22,880
and i think brian can actually speak

618
00:23:25,750 --> 00:23:24,880
more to some of uh some of nasa's role

619
00:23:28,630 --> 00:23:25,760
there

620
00:23:30,630 --> 00:23:28,640
but um in addition to the work that got

621
00:23:32,950 --> 00:23:30,640
the collier trophy there's actually a

622
00:23:35,750 --> 00:23:32,960
larger body of nasa research

623
00:23:38,070 --> 00:23:35,760
on adsb at all four of our aeronautics

624
00:23:39,750 --> 00:23:38,080
centers so in fact the the collier

625
00:23:42,230 --> 00:23:39,760
trophy um

626
00:23:43,750 --> 00:23:42,240
award was uh was was quite substantive

627
00:23:45,909 --> 00:23:43,760
and there's even more work that nasa is

628
00:23:47,110 --> 00:23:45,919
doing that's uh that's contributing to

629
00:23:49,590 --> 00:23:47,120
this

630
00:23:52,230 --> 00:23:49,600
it's a it's a it's a key technology that

631
00:23:55,110 --> 00:23:52,240
nasa recognizes has real potential to

632
00:23:57,190 --> 00:23:55,120
improve capacity and uh and safety in

633
00:23:58,789 --> 00:23:57,200
the nas in the in the future so we're

634
00:24:00,070 --> 00:23:58,799
we're very excited about uh about

635
00:24:01,669 --> 00:24:00,080
working on that

636
00:24:04,870 --> 00:24:01,679
oh yeah i would say there's probably

637
00:24:06,390 --> 00:24:04,880
been about a dozen or so adsb related

638
00:24:08,390 --> 00:24:06,400

research projects

639
00:24:10,470 --> 00:24:08,400
within nasa

640
00:24:13,830 --> 00:24:10,480
ranging from trying to improve safety on

641
00:24:15,990 --> 00:24:13,840
runways prevent runway incursions

642
00:24:17,350 --> 00:24:16,000
to increasing the

643
00:24:19,430 --> 00:24:17,360
throughput particularly during bad

644
00:24:22,630 --> 00:24:19,440
weather for closely spaced parallel

645
00:24:25,510 --> 00:24:22,640
runways which is an important um aspect

646
00:24:28,630 --> 00:24:25,520
of increasing the um

647
00:24:31,350 --> 00:24:28,640
the capacity of the airspace um

648
00:24:33,190 --> 00:24:31,360
video from uh chicago yeah

649
00:24:35,430 --> 00:24:33,200
so um

650
00:24:37,669 --> 00:24:35,440
this is showing some of the work this is

651
00:24:40,149 --> 00:24:37,679
uh one of the early trials of the

652
00:24:43,750 --> 00:24:40,159
airborne precision spacing work uh we

653
00:24:45,669 --> 00:24:43,760
took an early sample up to um chicago

654
00:24:47,350 --> 00:24:45,679
working with a couple of our

655
00:24:51,029 --> 00:24:47,360
industry partners at the time you can

656
00:24:53,190 --> 00:24:51,039
see one of the inside of one of the nasa

657
00:24:53,909 --> 00:24:53,200
research aircraft

658
00:24:56,549 --> 00:24:53,919
and

659
00:24:58,950 --> 00:24:56,559
we took this up there we

660
00:25:00,549 --> 00:24:58,960
flew it in chicago worked with the

661
00:25:02,630 --> 00:25:00,559
controllers

662
00:25:05,110 --> 00:25:02,640
up there trying out

663
00:25:07,190 --> 00:25:05,120

like i said some of the early prototypes

664
00:25:09,430 --> 00:25:07,200
of this work um

665
00:25:10,789 --> 00:25:09,440
one of the interesting things

666
00:25:12,630 --> 00:25:10,799
you're seeing right now some of the

667
00:25:15,269 --> 00:25:12,640
researchers working

668
00:25:16,710 --> 00:25:15,279
monitoring the the data analyzing it as

669
00:25:18,230 --> 00:25:16,720
it comes in

670
00:25:20,390 --> 00:25:18,240
one of the interesting things that we

671
00:25:22,630 --> 00:25:20,400
learned by going there was we were

672
00:25:24,630 --> 00:25:22,640
trying a way to merge the multiple

673
00:25:27,750 --> 00:25:24,640
traffic streams that robert had talked

674
00:25:29,669 --> 00:25:27,760
about earlier we had a very simple

675
00:25:30,390 --> 00:25:29,679
approach at the time we discovered that

676
00:25:34,950 --> 00:25:30,400
it

677
00:25:37,269 --> 00:25:34,960
be robust enough to use in a um

678
00:25:38,789 --> 00:25:37,279
a fully operational environment so we've

679
00:25:41,269 --> 00:25:38,799
actually gone back into the lab made

680
00:25:44,710 --> 00:25:41,279
some improvements on that um some of the

681
00:25:47,590 --> 00:25:44,720
stuff that they're now testing at ups

682
00:25:49,590 --> 00:25:47,600
has evolved um out of that

683
00:25:51,830 --> 00:25:49,600
that's great uh when it comes to

684
00:25:54,630 --> 00:25:51,840
research i know there's nothing like

685
00:25:57,190 --> 00:25:54,640
doing actual flight research yes

686
00:26:00,390 --> 00:25:57,200
so how talk some more about how we got

687
00:26:01,110 --> 00:26:00,400
involved in collaboration with ups okay

688
00:26:04,230 --> 00:26:01,120

well

689
00:26:06,630 --> 00:26:04,240
so um nasa really started probably um

690
00:26:09,430 --> 00:26:06,640
back in i guess it was about 30 years

691
00:26:10,470 --> 00:26:09,440
ago or so back in the late 70s looking

692
00:26:13,350 --> 00:26:10,480
at

693
00:26:15,590 --> 00:26:13,360
airborne precision spacing type of work

694
00:26:17,830 --> 00:26:15,600
the main focus was on separating

695
00:26:20,549 --> 00:26:17,840
aircraft or keeping them far enough

696
00:26:21,909 --> 00:26:20,559
apart on approach to avoid the wake

697
00:26:23,029 --> 00:26:21,919
vortices coming from the leading

698
00:26:25,269 --> 00:26:23,039
aircraft

699
00:26:27,029 --> 00:26:25,279
this was before the advent of adsb so it

700
00:26:28,230 --> 00:26:27,039
was using some very basic surveillance

701
00:26:29,430 --> 00:26:28,240
information

702
00:26:32,149 --> 00:26:29,440
and stuff

703
00:26:34,470 --> 00:26:32,159
we have continued uh working at refining

704
00:26:36,870 --> 00:26:34,480
it through the years

705
00:26:39,510 --> 00:26:36,880
as nancy said in the mid to late 90s

706
00:26:41,510 --> 00:26:39,520
nasa identified adsb as you know being a

707
00:26:43,430 --> 00:26:41,520
key transitional technology we started

708
00:26:44,950 --> 00:26:43,440
applying that with the

709
00:26:46,870 --> 00:26:44,960
not only do you get

710
00:26:49,029 --> 00:26:46,880
more precise information but you can

711
00:26:51,990 --> 00:26:49,039
actually get more information

712
00:26:53,269 --> 00:26:52,000
um from the other aircraft

713
00:26:55,190 --> 00:26:53,279

and so we

714
00:26:57,430 --> 00:26:55,200
started refining the concepts refining

715
00:27:00,149 --> 00:26:57,440
the the tools that we were using

716
00:27:01,669 --> 00:27:00,159
so we had a pretty mature research

717
00:27:02,789 --> 00:27:01,679
portfolio

718
00:27:05,750 --> 00:27:02,799
when

719
00:27:07,669 --> 00:27:05,760
ups started to to do their trials in

720
00:27:09,990 --> 00:27:07,679
louisville uh they started talking with

721
00:27:12,470 --> 00:27:10,000
the faa about wanting to

722
00:27:14,470 --> 00:27:12,480
actually try some of this technology out

723
00:27:17,510 --> 00:27:14,480
uh they were aware of the work that we

724
00:27:19,029 --> 00:27:17,520
had done uh so you know it was a natural

725
00:27:21,190 --> 00:27:19,039
partnership they came to us said that

726
00:27:22,470 --> 00:27:21,200
they wanted to use some of the work that

727
00:27:24,230 --> 00:27:22,480
we've been doing

728
00:27:26,630 --> 00:27:24,240
we were able to see this work actually

729
00:27:28,389 --> 00:27:26,640
get out into the field um as we

730
00:27:29,990 --> 00:27:28,399
mentioned there's nothing like

731
00:27:33,029 --> 00:27:30,000
having it out in the field to really

732
00:27:34,230 --> 00:27:33,039
learn the nuts and bolts

733
00:27:36,389 --> 00:27:34,240
of what you're getting so we're getting

734
00:27:37,830 --> 00:27:36,399
a lot of information back that way we're

735
00:27:40,070 --> 00:27:37,840
you know

736
00:27:42,230 --> 00:27:40,080
seeing things that we just can't see in

737
00:27:44,389 --> 00:27:42,240
a laboratory environment and we're able

738
00:27:46,549 --> 00:27:44,399

to take that back into the lab and make

739
00:27:47,590 --> 00:27:46,559
refinements make improvements and

740
00:27:49,830 --> 00:27:47,600
continue

741
00:27:50,950 --> 00:27:49,840
evolving our research

742
00:27:53,750 --> 00:27:50,960
that's great

743
00:27:55,750 --> 00:27:53,760
nancy as you mentioned earlier we're

744
00:28:00,389 --> 00:27:55,760
doing far more than

745
00:28:02,549 --> 00:28:00,399
just the capabilities to enable adsb

746
00:28:04,789 --> 00:28:02,559
what other wonderful things are we doing

747
00:28:07,590 --> 00:28:04,799
to help our valued

748
00:28:11,269 --> 00:28:07,600
partners like ups or faa

749
00:28:13,669 --> 00:28:11,279
yeah there's um there's actually um

750
00:28:15,590 --> 00:28:13,679
as uh brian was talking about the

751
00:28:18,389 --> 00:28:15,600
research that's gone on at langley i

752
00:28:21,830 --> 00:28:18,399
work at nasa ames and

753
00:28:24,630 --> 00:28:21,840
we have a long history of doing

754
00:28:28,470 --> 00:28:24,640
investigation and development of

755
00:28:32,950 --> 00:28:31,909
controllers and traffic managers in

756
00:28:37,669 --> 00:28:32,960
in

757
00:28:40,470 --> 00:28:37,679
uh one of those um

758
00:28:42,549 --> 00:28:40,480
applications an arrival scheduler

759
00:28:44,389 --> 00:28:42,559
application is actually particularly

760
00:28:45,909 --> 00:28:44,399
relevant to what we've been discussing

761
00:28:47,669 --> 00:28:45,919
today the

762
00:28:49,669 --> 00:28:47,679
the the work

763
00:28:51,830 --> 00:28:49,679

that involves

764
00:28:53,669 --> 00:28:51,840
the airborne precision spacing

765
00:28:54,789 --> 00:28:53,679
and what we

766
00:28:56,710 --> 00:28:54,799
were doing

767
00:28:58,870 --> 00:28:56,720
at ames and what my group was doing at

768
00:29:01,110 --> 00:28:58,880
ames was preparing to conduct a

769
00:29:03,430 --> 00:29:01,120
simulation that combined airborne

770
00:29:07,029 --> 00:29:03,440
precision spacing but

771
00:29:09,350 --> 00:29:07,039
with arrival scheduling so we used our

772
00:29:10,389 --> 00:29:09,360
expertise in

773
00:29:17,110 --> 00:29:10,399
in

774
00:29:21,590 --> 00:29:17,120
mocked up a concept simulated a concept

775
00:29:25,269 --> 00:29:23,430
to

776
00:29:26,710 --> 00:29:25,279
organize the aircraft so that when they

777
00:29:29,750 --> 00:29:26,720
came together at the merge they were

778
00:29:32,149 --> 00:29:29,760
well positioned to uh to pair up and to

779
00:29:34,070 --> 00:29:32,159
uh to to self-space

780
00:29:36,070 --> 00:29:34,080
so uh we were getting ready to do that

781
00:29:37,590 --> 00:29:36,080
in 2005. we were preparing to run a

782
00:29:40,789 --> 00:29:37,600
human in the loop simulation of this

783
00:29:42,710 --> 00:29:40,799
concept and we have a a researcher with

784
00:29:45,269 --> 00:29:42,720
our team who's

785
00:29:47,110 --> 00:29:45,279
been involved with the ups activity so

786
00:29:48,789 --> 00:29:47,120
we ended up making some changes to our

787
00:29:50,710 --> 00:29:48,799
concept so that it would emulate what

788
00:29:53,350 --> 00:29:50,720

was going on in louisville and i'll talk

789
00:29:55,590 --> 00:29:53,360
more about that later but first i wanted

790
00:29:57,669 --> 00:29:55,600
to say a little bit about

791
00:29:59,350 --> 00:29:57,679
in addition to the flight tests uh some

792
00:30:01,510 --> 00:29:59,360
of the the kind of things that we can

793
00:30:03,510 --> 00:30:01,520
learn and what we do in uh laboratory

794
00:30:05,430 --> 00:30:03,520
simulations as well and i've got a

795
00:30:08,070 --> 00:30:05,440
couple of my colleagues from uh from

796
00:30:10,710 --> 00:30:08,080
ames from the air space operations lab

797
00:30:12,710 --> 00:30:10,720
and we have a video clip that

798
00:30:15,110 --> 00:30:12,720
shows them describing

799
00:30:17,909 --> 00:30:15,120
what we do there

800
00:30:19,110 --> 00:30:17,919
this facility is the airspace operations

801
00:30:21,669 --> 00:30:19,120
lab

802
00:30:23,029 --> 00:30:21,679
we use it to rapidly prototype and

803
00:30:25,430 --> 00:30:23,039
investigate

804
00:30:28,630 --> 00:30:25,440
future air traffic concepts

805
00:30:31,990 --> 00:30:28,640
so it's aimed at operations research

806
00:30:34,549 --> 00:30:32,000
with people pilots and controllers and

807
00:30:37,269 --> 00:30:34,559
with new technologies the current air

808
00:30:39,830 --> 00:30:37,279
transportation system is very safe but

809
00:30:41,590 --> 00:30:39,840
it's also fairly outdated

810
00:30:44,789 --> 00:30:41,600
and so there is a

811
00:30:47,029 --> 00:30:44,799
very broad modernization effort ongoing

812
00:30:48,630 --> 00:30:47,039
and there is also

813
00:30:50,630 --> 00:30:48,640

the plans are in place for the next

814
00:30:52,549 --> 00:30:50,640
generation air transportation

815
00:30:55,669 --> 00:30:52,559
system that is envisioned to replace the

816
00:30:57,509 --> 00:30:55,679
current system over the next two decades

817
00:30:59,990 --> 00:30:57,519
we're particularly interested in the

818
00:31:01,750 --> 00:31:00,000
role of humans in in that kind of system

819
00:31:03,509 --> 00:31:01,760
and the

820
00:31:05,190 --> 00:31:03,519
different roles of the what the pilots

821
00:31:07,029 --> 00:31:05,200
might do and what they could do on the

822
00:31:09,830 --> 00:31:07,039
ground so we were looking at both

823
00:31:11,350 --> 00:31:09,840
cockpits and air traffic controllers on

824
00:31:13,909 --> 00:31:11,360
ground systems now how the whole thing

825
00:31:15,750 --> 00:31:13,919
would work together this research really

826
00:31:17,269 --> 00:31:15,760
is using an awful lot of the tools that

827
00:31:20,070 --> 00:31:17,279
are being talked about for next year

828
00:31:21,430 --> 00:31:20,080
it's using adsb satellite navigation

829
00:31:23,269 --> 00:31:21,440
it's using

830
00:31:25,669 --> 00:31:23,279
datalink communications to send up

831
00:31:27,509 --> 00:31:25,679
trajectories to airplanes nextgen is

832
00:31:29,430 --> 00:31:27,519
very much sending up whole paths for an

833
00:31:31,750 --> 00:31:29,440
airplane to fly

834
00:31:33,669 --> 00:31:31,760
and that's what this is doing that the

835
00:31:35,029 --> 00:31:33,679
controllers are communicating with the

836
00:31:38,950 --> 00:31:35,039
pilots

837
00:31:43,830 --> 00:31:41,750
so as you just heard we

838
00:31:45,590 --> 00:31:43,840

have incorporated some of these advanced

839
00:31:47,110 --> 00:31:45,600
next-gen capabilities into our

840
00:31:49,029 --> 00:31:47,120
simulation lab

841
00:31:51,430 --> 00:31:49,039
and we

842
00:31:54,470 --> 00:31:51,440
integrated a suite of that functionality

843
00:31:56,389 --> 00:31:54,480
to be able to test this this concept uh

844
00:31:58,389 --> 00:31:56,399
that we called two wild for trajectory

845
00:32:00,710 --> 00:31:58,399
oriented operations with limited

846
00:32:01,669 --> 00:32:00,720
delegation

847
00:32:07,669 --> 00:32:01,679
i

848
00:32:09,590 --> 00:32:07,679
actually

849
00:32:10,389 --> 00:32:09,600
follows up on what evan tom were saying

850
00:32:11,990 --> 00:32:10,399
and

851
00:32:13,669 --> 00:32:12,000
shows you what our lab looks like when

852
00:32:14,950 --> 00:32:13,679
we're actually running simulations so

853
00:32:16,230 --> 00:32:14,960
you can get a little bit more of a feel

854
00:32:19,590 --> 00:32:16,240
for what we do

855
00:32:21,830 --> 00:32:19,600
so so this is our air traffic controller

856
00:32:24,630 --> 00:32:21,840
lab and what you see is

857
00:32:25,509 --> 00:32:24,640
some controller stations and on the back

858
00:32:27,190 --> 00:32:25,519
wall

859
00:32:29,590 --> 00:32:27,200
there's a

860
00:32:31,190 --> 00:32:29,600
projection of the traffic problem that

861
00:32:33,430 --> 00:32:31,200
the controllers are working now in this

862
00:32:35,909 --> 00:32:33,440
case it was the louisville traffic

863
00:32:37,750 --> 00:32:35,919

problem um similar to what bob was

864
00:32:40,149 --> 00:32:37,760
showing but we were just sort of

865
00:32:42,710 --> 00:32:40,159
simulating one one quarter of that

866
00:32:47,110 --> 00:32:42,720
of that full rival airspace we've got

867
00:32:52,470 --> 00:32:49,909
stations that are a

868
00:32:53,590 --> 00:32:52,480
emulation of what they actually have in

869
00:32:54,710 --> 00:32:53,600
the field

870
00:32:56,630 --> 00:32:54,720
with

871
00:32:58,310 --> 00:32:56,640
some advanced tools and functionality

872
00:33:00,310 --> 00:32:58,320
integrated in so the weather display

873
00:33:01,990 --> 00:33:00,320
that you're seeing that timeline off to

874
00:33:03,190 --> 00:33:02,000
the right and the

875
00:33:09,029 --> 00:33:03,200
um

876
00:33:11,669 --> 00:33:09,039
additions that

877
00:33:13,750 --> 00:33:11,679
are part of this

878
00:33:16,470 --> 00:33:13,760
emulated next-gen tool suite that the

879
00:33:18,070 --> 00:33:16,480
controllers are using to work this uh

880
00:33:24,389 --> 00:33:18,080
this

881
00:33:25,830 --> 00:33:24,399
again a little bit of an enhancement on

882
00:33:29,430 --> 00:33:25,840
today's

883
00:33:31,750 --> 00:33:29,440
displays we have some color-coded

884
00:33:32,870 --> 00:33:31,760
data blocks and again the the timeline

885
00:33:34,630 --> 00:33:32,880
on the left

886
00:33:36,630 --> 00:33:34,640
but what the controllers are doing here

887
00:33:38,070 --> 00:33:36,640
they have some aircraft so this is our

888
00:33:39,909 --> 00:33:38,080

two-wire simulation they have some

889
00:33:41,909 --> 00:33:39,919
aircraft that were capable of

890
00:33:42,870 --> 00:33:41,919
self-spacing and some aircraft that were

891
00:33:45,029 --> 00:33:42,880
not

892
00:33:46,149 --> 00:33:45,039
and they were working a problem that

893
00:33:47,269 --> 00:33:46,159
integrated

894
00:33:50,310 --> 00:33:47,279
the self-spacing and the

895
00:33:52,149 --> 00:33:50,320
non-self-spacing aircraft into a single

896
00:33:53,430 --> 00:33:52,159
arrival stream using this timeline for

897
00:33:55,110 --> 00:33:53,440
coordination

898
00:33:58,389 --> 00:33:55,120
now what you see here

899
00:33:59,269 --> 00:33:58,399
is one of our pseudo-pilots and we have

900
00:34:03,350 --> 00:33:59,279
to

901
00:34:07,830 --> 00:34:06,149
some confederate pilots who are

902
00:34:09,349 --> 00:34:07,840
responding to the clearances that the

903
00:34:11,750 --> 00:34:09,359
controllers give

904
00:34:14,629 --> 00:34:11,760
and we call those guys pseudo-pilots um

905
00:34:17,030 --> 00:34:14,639
but what that uh what that

906
00:34:20,310 --> 00:34:17,040
gives us is the controller is working a

907
00:34:22,470 --> 00:34:20,320
rich complex uh fully responsive problem

908
00:34:25,349 --> 00:34:22,480
so so basically

909
00:34:28,470 --> 00:34:25,359
every aircraft that's in there in their

910
00:34:32,149 --> 00:34:28,480
scope is something that responds to them

911
00:34:33,909 --> 00:34:32,159
so this is a slide that shows

912
00:34:35,669 --> 00:34:33,919
actually the the two labs that were

913
00:34:38,069 --> 00:34:35,679

involved in the simulation what i was

914
00:34:39,750 --> 00:34:38,079
showing you earlier in the video is just

915
00:34:42,710 --> 00:34:39,760
some footage from our airspace

916
00:34:46,629 --> 00:34:42,720
operations lab but in fact we also had

917
00:34:49,829 --> 00:34:46,639
um eight uh commercial pilots

918
00:34:51,750 --> 00:34:49,839
who were test participants in this

919
00:34:53,589 --> 00:34:51,760
simulation study in addition to our four

920
00:34:57,349 --> 00:34:53,599
air traffic controllers

921
00:35:00,630 --> 00:34:57,359
and they were working at um

922
00:35:03,510 --> 00:35:00,640
desktop simulators and flying uh the

923
00:35:06,950 --> 00:35:03,520
aircraft in the simulation

924
00:35:11,430 --> 00:35:09,030
had some advanced displays were able to

925
00:35:13,349 --> 00:35:11,440
to to execute the

926
00:35:15,349 --> 00:35:13,359
the adsb

927
00:35:17,670 --> 00:35:15,359
airborne precision spacing

928
00:35:18,790 --> 00:35:17,680
clearances that they were assigned

929
00:35:20,630 --> 00:35:18,800
and

930
00:35:22,069 --> 00:35:20,640
so i think if you

931
00:35:23,990 --> 00:35:22,079
if you could show

932
00:35:26,710 --> 00:35:24,000
the next slide please

933
00:35:27,990 --> 00:35:26,720
i just wanted to give you one sample of

934
00:35:29,430 --> 00:35:28,000
the data that we had from this

935
00:35:31,109 --> 00:35:29,440
simulation

936
00:35:32,950 --> 00:35:31,119
and this

937
00:35:35,750 --> 00:35:32,960
i guess speaks to a point that both bob

938
00:35:38,470 --> 00:35:35,760

and robert were making earlier that that

939
00:35:42,069 --> 00:35:38,480
if you have self-spacing aircraft

940
00:35:45,109 --> 00:35:42,079
you are going to be able to um

941
00:35:46,710 --> 00:35:45,119
to have tighter control and more precise

942
00:35:49,109 --> 00:35:46,720
control over the spacing interval

943
00:35:50,870 --> 00:35:49,119
between a lead aircraft and and the

944
00:35:51,910 --> 00:35:50,880
aircraft that it's space that's facing

945
00:35:54,069 --> 00:35:51,920
off of it

946
00:35:55,670 --> 00:35:54,079
uh what you see here in red

947
00:35:56,710 --> 00:35:55,680
are um

948
00:35:57,910 --> 00:35:56,720
are

949
00:35:58,950 --> 00:35:57,920
well i guess i should explain what the

950
00:36:01,190 --> 00:35:58,960
plot is

951
00:36:03,990 --> 00:36:01,200
um it's um

952
00:36:06,069 --> 00:36:04,000
what you're seeing is the error between

953
00:36:07,190 --> 00:36:06,079
the target interval

954
00:36:07,990 --> 00:36:07,200
and

955
00:36:14,310 --> 00:36:08,000
the

956
00:36:16,550 --> 00:36:14,320
simulation

957
00:36:18,230 --> 00:36:16,560
at the runway threshold

958
00:36:19,589 --> 00:36:18,240
and what you see in red

959
00:36:20,870 --> 00:36:19,599
is how

960
00:36:23,829 --> 00:36:20,880
tightly

961
00:36:26,790 --> 00:36:23,839
the target interval was achieved

962
00:36:29,430 --> 00:36:26,800
when the aircraft were self-spacing so

963
00:36:31,270 --> 00:36:29,440

the accuracy was

964
00:36:33,030 --> 00:36:31,280
within one and a half seconds plus or

965
00:36:35,430 --> 00:36:33,040
minus five seconds i mean that's that's

966
00:36:39,190 --> 00:36:35,440
that's really pretty remarkable the

967
00:36:41,910 --> 00:36:39,200
alternative uh non-spacing uh condition

968
00:36:44,150 --> 00:36:41,920
had um the controllers issuing speed

969
00:36:46,230 --> 00:36:44,160
instructions again using tools so this

970
00:36:48,550 --> 00:36:46,240
is also advanced operations

971
00:36:50,550 --> 00:36:48,560
and um and so the controllers were

972
00:36:52,310 --> 00:36:50,560
responsible for maintaining the spacing

973
00:36:56,630 --> 00:36:52,320
and they did a great job too but with

974
00:37:01,589 --> 00:36:59,190
less precise uh control over that over

975
00:37:03,829 --> 00:37:01,599
that interval so again this this sort of

976
00:37:06,069 --> 00:37:03,839
gives you a good uh good indication of

977
00:37:08,470 --> 00:37:06,079
how much the

978
00:37:11,109 --> 00:37:08,480
the spacing application can actually can

979
00:37:13,190 --> 00:37:11,119
actually help great thank you nancy i i

980
00:37:15,109 --> 00:37:13,200
have been to that lab

981
00:37:17,109 --> 00:37:15,119
and

982
00:37:19,990 --> 00:37:17,119
they are not acting up because they were

983
00:37:21,589 --> 00:37:20,000
being taped they always looked at carmen

984
00:37:24,230 --> 00:37:21,599
professional

985
00:37:26,230 --> 00:37:24,240
and um

986
00:37:27,349 --> 00:37:26,240
but i think the benefits of your

987
00:37:29,750 --> 00:37:27,359
research

988
00:37:33,430 --> 00:37:29,760

are wild so that

989
00:37:35,190 --> 00:37:33,440
name too wild is very fitting i think

990
00:37:37,510 --> 00:37:35,200
um

991
00:37:38,790 --> 00:37:37,520
so so let's talk a little bit more about

992
00:37:41,510 --> 00:37:38,800
that um

993
00:37:43,990 --> 00:37:41,520
out of the uh collaboration with ups

994
00:37:47,270 --> 00:37:44,000
what what kind of benefits did you get

995
00:37:50,390 --> 00:37:47,280
to improve uh too wild okay

996
00:37:52,310 --> 00:37:50,400
well it it it did change the the way

997
00:37:53,349 --> 00:37:52,320
that we ran the simulation we for

998
00:37:54,230 --> 00:37:53,359
instance

999
00:38:00,069 --> 00:37:54,240
um

1000
00:38:02,870 --> 00:38:00,079
and and in the case of this simulation

1001
00:38:04,870 --> 00:38:02,880
it was uh someone who was

1002
00:38:07,190 --> 00:38:04,880
setting things up before the aircraft

1003
00:38:08,790 --> 00:38:07,200
actually uh reached the uh the

1004
00:38:12,310 --> 00:38:08,800
controller sector

1005
00:38:14,790 --> 00:38:12,320
and uh at ups that operations is uh is

1006
00:38:17,109 --> 00:38:14,800
is being tested as something that's done

1007
00:38:19,270 --> 00:38:17,119
by the airline dispatcher so that was an

1008
00:38:21,670 --> 00:38:19,280
interesting thing for us to uh to add to

1009
00:38:23,990 --> 00:38:21,680
the simulation was this

1010
00:38:25,270 --> 00:38:24,000
this uh third party who's actually kind

1011
00:38:29,190 --> 00:38:25,280
of preparing the problem for the

1012
00:38:34,710 --> 00:38:31,670
the other thing that that we got out of

1013
00:38:34,720 --> 00:38:37,430

that

1014
00:38:42,710 --> 00:38:40,390
it it gave us a chance to

1015
00:38:44,630 --> 00:38:42,720
look at

1016
00:38:46,950 --> 00:38:44,640
how

1017
00:38:51,109 --> 00:38:46,960
a single carrier operation

1018
00:38:51,910 --> 00:38:51,119
could uh could could mix with um

1019
00:38:53,030 --> 00:38:51,920
with

1020
00:39:05,829 --> 00:38:53,040
a

1021
00:39:07,190 --> 00:39:05,839
quite interesting

1022
00:39:18,390 --> 00:39:07,200
um

1023
00:39:20,550 --> 00:39:18,400
input to our simulation

1024
00:39:23,109 --> 00:39:20,560
that uh that definitely made it a a

1025
00:39:25,589 --> 00:39:23,119
richer problem for us to work

1026
00:39:27,430 --> 00:39:25,599
and hopefully provided some uh some

1027
00:39:29,349 --> 00:39:27,440
insights and some

1028
00:39:31,750 --> 00:39:29,359
some benefit to the to the merging and

1029
00:39:34,390 --> 00:39:31,760
spacing and ups operations as well

1030
00:39:36,790 --> 00:39:34,400
right i think you summed up well that

1031
00:39:39,510 --> 00:39:36,800
that's the value of partnership with our

1032
00:39:43,910 --> 00:39:41,589
so in in closing

1033
00:39:46,870 --> 00:39:43,920
let's hear some preview

1034
00:39:49,190 --> 00:39:46,880
what what are the next steps

1035
00:39:50,550 --> 00:39:49,200
for nasa and what what are you guys

1036
00:39:53,349 --> 00:39:50,560
working on

1037
00:39:55,190 --> 00:39:53,359
that will bring on new capabilities that

1038
00:39:56,790 --> 00:39:55,200

we cannot

1039
00:39:57,910 --> 00:39:56,800
practice today

1040
00:39:59,589 --> 00:39:57,920
uh well

1041
00:40:01,030 --> 00:39:59,599
so there's still a lot of work to be

1042
00:40:04,470 --> 00:40:01,040
done um

1043
00:40:05,589 --> 00:40:04,480
in in louisville right now the focus has

1044
00:40:07,510 --> 00:40:05,599
been on the

1045
00:40:10,710 --> 00:40:07,520
ups only operations in the middle of the

1046
00:40:12,950 --> 00:40:10,720
night um so there needs to still be

1047
00:40:14,550 --> 00:40:12,960
some work on extending that into daytime

1048
00:40:17,109 --> 00:40:14,560
operations where they're having to

1049
00:40:18,790 --> 00:40:17,119
interact with other airlines that are

1050
00:40:19,670 --> 00:40:18,800
particularly bringing in passengers and

1051
00:40:22,470 --> 00:40:19,680
stuff

1052
00:40:25,030 --> 00:40:22,480
um but then moving from there the real

1053
00:40:27,109 --> 00:40:25,040
goal the real impact of this work on the

1054
00:40:29,190 --> 00:40:27,119
national airspace system is when you can

1055
00:40:32,470 --> 00:40:29,200
start doing this at the really busy hubs

1056
00:40:34,710 --> 00:40:32,480
the places like chicago atlanta

1057
00:40:37,109 --> 00:40:34,720
san francisco those types of places

1058
00:40:39,109 --> 00:40:37,119
where any sort of delay or disruption

1059
00:40:41,430 --> 00:40:39,119
that occurs ripples throughout the

1060
00:40:44,069 --> 00:40:41,440
entire system so we really need to start

1061
00:40:46,550 --> 00:40:44,079
working at how you integrate the

1062
00:40:49,270 --> 00:40:46,560
those who can do this with uh those who

1063
00:40:50,390 --> 00:40:49,280

have not yet equipped um who or who

1064
00:40:53,109 --> 00:40:50,400
choose not

1065
00:40:55,910 --> 00:40:53,119
to equip um you know a much more

1066
00:40:58,069 --> 00:40:55,920
complicated mix of aircraft types all

1067
00:40:59,750 --> 00:40:58,079
that kind of stuff's going to

1068
00:41:02,069 --> 00:40:59,760
add more difficulty to the problem and

1069
00:41:04,950 --> 00:41:02,079
so so there's still a lot of work we're

1070
00:41:07,349 --> 00:41:04,960
doing stuff in the lab right now on

1071
00:41:08,390 --> 00:41:07,359
testing new ideas on on how to use this

1072
00:41:12,710 --> 00:41:08,400
in a

1073
00:41:16,950 --> 00:41:14,390
and much along

1074
00:41:18,390 --> 00:41:16,960
the the same lines there's uh there's

1075
00:41:20,309 --> 00:41:18,400
ongoing work at

1076
00:41:22,230 --> 00:41:20,319
ames developing the scheduling

1077
00:41:24,630 --> 00:41:22,240
applications to really be able to handle

1078
00:41:25,750 --> 00:41:24,640
these complex problems

1079
00:41:33,829 --> 00:41:25,760
the

1080
00:41:34,870 --> 00:41:33,839
merging from multiple directions and

1081
00:41:37,990 --> 00:41:34,880
had the

1082
00:41:39,990 --> 00:41:38,000
the red and yellow coated slots the the

1083
00:41:42,470 --> 00:41:40,000
the green slots being filled

1084
00:41:45,430 --> 00:41:42,480
by uh by aircraft that change color

1085
00:41:47,829 --> 00:41:45,440
that's um a pretty challenging

1086
00:41:50,470 --> 00:41:47,839
scheduling problem and there's work

1087
00:41:51,349 --> 00:41:50,480
going on right now at nasa to uh

1088
00:41:54,230 --> 00:41:51,359

to

1089
00:41:56,230 --> 00:41:54,240
explore how you would manage that and

1090
00:41:58,950 --> 00:41:56,240
also be able to support these continuous

1091
00:42:00,230 --> 00:41:58,960
descent arrivals so it's um

1092
00:42:02,069 --> 00:42:00,240
it's it's

1093
00:42:03,829 --> 00:42:02,079
there's some interesting stuff happening

1094
00:42:06,069 --> 00:42:03,839
that's again directly related to what

1095
00:42:09,030 --> 00:42:06,079
we've been talking about today great

1096
00:42:11,030 --> 00:42:09,040
nancy and brian thanks so much i'm

1097
00:42:13,750 --> 00:42:11,040
looking forward to all the good stuff

1098
00:42:17,030 --> 00:42:13,760
coming out of your research

1099
00:42:20,870 --> 00:42:17,040
as as robert from faa mentioned

1100
00:42:23,030 --> 00:42:20,880
they are expanding adsb to wider

1101
00:42:26,309 --> 00:42:23,040
ranges and more airports

1102
00:42:28,950 --> 00:42:26,319
so i can envision i can envision that my

1103
00:42:30,710 --> 00:42:28,960
neighbor in near future

1104
00:42:33,829 --> 00:42:30,720
talking to me that hey

1105
00:42:35,510 --> 00:42:33,839
my my flight was aided by adsb

1106
00:42:38,470 --> 00:42:35,520
today so

1107
00:42:39,990 --> 00:42:38,480
i i'm envisioning that adsb becoming a

1108
00:42:42,390 --> 00:42:40,000
household name

1109
00:42:44,870 --> 00:42:42,400
out of uh your excellent

1110
00:42:47,109 --> 00:42:44,880
research and our collaboration so again

1111
00:42:48,870 --> 00:42:47,119
thank you very much and i'm very proud

1112
00:42:50,390 --> 00:42:48,880
of you thank you thank you thank you

1113
00:42:51,990 --> 00:42:50,400

thank you all next we'll take some

1114
00:42:53,510 --> 00:42:52,000
questions from our audience but first

1115
00:42:55,190 --> 00:42:53,520
we'd like to give you an opportunity to

1116
00:42:57,750 --> 00:42:55,200
get acquainted with another one of our

1117
00:43:15,190 --> 00:42:57,760
aeronautics research centers the dryden

1118
00:43:15,200 --> 00:44:29,030
so

1119
00:44:29,040 --> 00:45:16,230
do

1120
00:45:20,390 --> 00:45:17,910
you're watching the leading edge an

1121
00:45:22,470 --> 00:45:20,400
aeronautics research discussion program

1122
00:45:24,230 --> 00:45:22,480
brought to you by nasa we've been

1123
00:45:27,589 --> 00:45:24,240
discussing automatic dependent

1124
00:45:29,829 --> 00:45:27,599
surveillance broadcast or adsv and

1125
00:45:32,710 --> 00:45:29,839
nasa's airborne precision spacing

1126
00:45:35,589 --> 00:45:32,720
research our panelists today are robert

1127
00:45:36,950 --> 00:45:35,599
novia of the faa bob hill representing

1128
00:45:39,430 --> 00:45:36,960
ups

1129
00:45:42,550 --> 00:45:39,440
nancy smith and brian barr moore who are

1130
00:45:44,950 --> 00:45:42,560
with us at nasa as researchers and we're

1131
00:45:47,270 --> 00:45:44,960
ready to take some questions here uh at

1132
00:45:49,589 --> 00:45:47,280
nasa headquarters in the audience do we

1133
00:45:52,150 --> 00:45:49,599
have anyone

1134
00:45:53,990 --> 00:45:52,160
i was fascinated by the earlier graphic

1135
00:45:56,309 --> 00:45:54,000
you showed with the dollar signs blowing

1136
00:45:58,230 --> 00:45:56,319
out the back end of the airplane and i

1137
00:46:00,870 --> 00:45:58,240
thought that did a nice job of

1138
00:46:03,109 --> 00:46:00,880

demonstrating that the economic impact

1139
00:46:05,270 --> 00:46:03,119
of nasa's research what i'm curious

1140
00:46:07,030 --> 00:46:05,280
about is uh and to try to understand

1141
00:46:08,390 --> 00:46:07,040
better is then what's the next step in

1142
00:46:11,750 --> 00:46:08,400
the process

1143
00:46:14,710 --> 00:46:11,760
of how do we go from the research to

1144
00:46:17,109 --> 00:46:14,720
implementation in an operational sense

1145
00:46:18,950 --> 00:46:17,119
what's nasa's role in that is that an

1146
00:46:21,510 --> 00:46:18,960
faa decision

1147
00:46:25,270 --> 00:46:21,520
or is that something uh the airlines

1148
00:46:31,589 --> 00:46:28,950
okay is that directed to me okay

1149
00:46:34,470 --> 00:46:31,599
so um when i was describing the the

1150
00:46:38,309 --> 00:46:34,480
initial sbs or adsb program office

1151
00:46:40,309 --> 00:46:38,319
objective uh i was speaking mostly

1152
00:46:42,790 --> 00:46:40,319
about just providing surveillance for

1153
00:46:44,230 --> 00:46:42,800
atc to provide separation services the

1154
00:46:46,630 --> 00:46:44,240
way they do today

1155
00:46:49,829 --> 00:46:46,640
but really the the true value with the

1156
00:46:52,150 --> 00:46:49,839
adsb technology is the adsb in component

1157
00:46:54,790 --> 00:46:52,160
where we uplink

1158
00:46:56,390 --> 00:46:54,800
traffic data to the cockpit and that

1159
00:46:58,390 --> 00:46:56,400
really opens up all kinds of

1160
00:47:00,390 --> 00:46:58,400
opportunities to to have advanced

1161
00:47:02,550 --> 00:47:00,400
applications and to realize some of

1162
00:47:04,150 --> 00:47:02,560
these uh spacing initiatives

1163
00:47:06,550 --> 00:47:04,160

the uh the probably the biggest

1164
00:47:08,069 --> 00:47:06,560
challenge we face is for an extended

1165
00:47:11,190 --> 00:47:08,079
period of time we're going to be in a

1166
00:47:13,030 --> 00:47:11,200
mixed uh equipage environment mode so we

1167
00:47:14,390 --> 00:47:13,040
would we're

1168
00:47:17,030 --> 00:47:14,400
we're in a tough spot of trying to

1169
00:47:18,870 --> 00:47:17,040
develop operational concepts that work

1170
00:47:21,349 --> 00:47:18,880
for when only part of the aircraft in

1171
00:47:24,790 --> 00:47:21,359
the airspace are equipped so that's

1172
00:47:26,069 --> 00:47:24,800
that's where most of our focus is now we

1173
00:47:30,390 --> 00:47:26,079
we have

1174
00:47:32,549 --> 00:47:30,400
applications adsbn

1175
00:47:35,190 --> 00:47:32,559
with the faa work associated with that

1176
00:47:37,190 --> 00:47:35,200
we have three uh adsb in applications

1177
00:47:39,589 --> 00:47:37,200
that we're developing one is is an

1178
00:47:43,430 --> 00:47:39,599
oceanic application called entrail

1179
00:47:45,030 --> 00:47:43,440
procedures where two aircraft that are

1180
00:47:46,549 --> 00:47:45,040
have less than standard oceanic

1181
00:47:49,670 --> 00:47:46,559
separation but they're separated by

1182
00:47:51,109 --> 00:47:49,680
altitude one can climb through the other

1183
00:47:53,349 --> 00:47:51,119
if the

1184
00:47:56,230 --> 00:47:53,359
aircraft has the either the the

1185
00:47:58,470 --> 00:47:56,240
proceeding or the trailing aircraft uh

1186
00:48:00,150 --> 00:47:58,480
on their display in the cockpit and

1187
00:48:02,069 --> 00:48:00,160
through a set of procedures with air

1188
00:48:04,549 --> 00:48:02,079

traffic control we can actually give

1189
00:48:06,390 --> 00:48:04,559
them a climber descent instead of them

1190
00:48:08,710 --> 00:48:06,400
being stuck at that altitude in some

1191
00:48:11,670 --> 00:48:08,720
cases over the entire pacific ocean for

1192
00:48:15,190 --> 00:48:11,680
six eight ten hours at a time so that's

1193
00:48:17,990 --> 00:48:15,200
that is probably our most mature adsb in

1194
00:48:19,510 --> 00:48:18,000
application we are also pursuing

1195
00:48:22,549 --> 00:48:19,520
initially we were calling it

1196
00:48:25,109 --> 00:48:22,559
merging and spacing now we're we've used

1197
00:48:27,190 --> 00:48:25,119
the term interval management to describe

1198
00:48:28,069 --> 00:48:27,200
any adsbn application that has to do

1199
00:48:30,150 --> 00:48:28,079
with the

1200
00:48:33,190 --> 00:48:30,160
spacing function

1201
00:48:35,109 --> 00:48:33,200
so we're sponsoring that and we we also

1202
00:48:37,750 --> 00:48:35,119
are trying to mature and accelerate the

1203
00:48:39,510 --> 00:48:37,760
standards for a surface application

1204
00:48:42,150 --> 00:48:39,520
whereby the flight crew can get

1205
00:48:43,670 --> 00:48:42,160
indications and alerts when

1206
00:48:45,109 --> 00:48:43,680
when um

1207
00:48:47,349 --> 00:48:45,119
something slipped through the crack you

1208
00:48:49,109 --> 00:48:47,359
know this this is this is meant to

1209
00:48:51,030 --> 00:48:49,119
give a a a

1210
00:48:53,349 --> 00:48:51,040
to act as a safety net to prevent a

1211
00:48:55,670 --> 00:48:53,359
runway incursion or

1212
00:48:57,430 --> 00:48:55,680
a last ditched effort for the flight

1213
00:48:59,750 --> 00:48:57,440

crew to see something and again this

1214
00:49:00,870 --> 00:48:59,760
would be an adsb in application in that

1215
00:49:02,470 --> 00:49:00,880
air traffic control will be doing

1216
00:49:04,630 --> 00:49:02,480
business as usual but something went

1217
00:49:08,150 --> 00:49:04,640
wrong and now the the flight crew

1218
00:49:10,309 --> 00:49:08,160
because of the the uplink of adsb uh

1219
00:49:12,950 --> 00:49:10,319
information their cockpit they can pick

1220
00:49:14,790 --> 00:49:12,960
up a situation unfolding and and

1221
00:49:16,630 --> 00:49:14,800
potentially uh avert something very

1222
00:49:18,870 --> 00:49:16,640
serious from happening

1223
00:49:20,470 --> 00:49:18,880
and if i can add from the nasa side

1224
00:49:23,030 --> 00:49:20,480
first of all all three of those

1225
00:49:25,670 --> 00:49:23,040
applications have been

1226
00:49:29,349 --> 00:49:25,680
have research going on at nasa

1227
00:49:30,950 --> 00:49:29,359
to develop them in addition

1228
00:49:31,910 --> 00:49:30,960
particularly the spacing one i know

1229
00:49:33,670 --> 00:49:31,920
about

1230
00:49:35,670 --> 00:49:33,680
bob and i are on a international

1231
00:49:37,910 --> 00:49:35,680
standards committee and this is one of

1232
00:49:40,309 --> 00:49:37,920
the ways where this type of information

1233
00:49:42,230 --> 00:49:40,319
nasa can get out to the community we're

1234
00:49:45,270 --> 00:49:42,240
working to help set

1235
00:49:47,270 --> 00:49:45,280
equipment standards where the airlines

1236
00:49:49,510 --> 00:49:47,280
or the avionics manufacturers i guess

1237
00:49:51,190 --> 00:49:49,520
can go and use that to develop

1238
00:49:52,790 --> 00:49:51,200

equipment that will conform to these

1239
00:49:54,790 --> 00:49:52,800
types of operations

1240
00:49:58,069 --> 00:49:54,800
so that's another good avenue where nasa

1241
00:49:59,910 --> 00:49:58,079
can get what we've been doing out to

1242
00:50:01,829 --> 00:49:59,920
industry to make use of

1243
00:50:03,750 --> 00:50:01,839
all right let's take another question

1244
00:50:05,750 --> 00:50:03,760
yeah i have a question there's there's

1245
00:50:07,910 --> 00:50:05,760
no doubt in my mind that the quality of

1246
00:50:11,349 --> 00:50:07,920
the situational awareness

1247
00:50:14,150 --> 00:50:11,359
is enriched by the different components

1248
00:50:16,710 --> 00:50:14,160
that you've added my question is that as

1249
00:50:18,950 --> 00:50:16,720
you add more components the likelihood

1250
00:50:21,829 --> 00:50:18,960
of getting conflicting

1251
00:50:23,990 --> 00:50:21,839
data might increase is there a protocol

1252
00:50:26,390 --> 00:50:24,000
for conflict resolution

1253
00:50:27,589 --> 00:50:26,400
if certain sets of data indicate

1254
00:50:29,190 --> 00:50:27,599
a certain

1255
00:50:31,349 --> 00:50:29,200
sort of pathway where there's another

1256
00:50:33,190 --> 00:50:31,359
set of data

1257
00:50:35,349 --> 00:50:33,200
or am i

1258
00:50:37,030 --> 00:50:35,359
not

1259
00:50:38,790 --> 00:50:37,040
sort of you you know as you add more

1260
00:50:40,950 --> 00:50:38,800
components there's going to be some

1261
00:50:42,309 --> 00:50:40,960
likelihood either due to faulty sensor

1262
00:50:44,630 --> 00:50:42,319
data or

1263
00:50:46,950 --> 00:50:44,640

something or whether or whatever that

1264
00:50:48,390 --> 00:50:46,960
there is a sort of a conflict resolution

1265
00:50:49,510 --> 00:50:48,400
protocol

1266
00:50:50,309 --> 00:50:49,520
so that

1267
00:50:52,829 --> 00:50:50,319
one

1268
00:50:55,430 --> 00:50:52,839
thing trumps another in case there's a

1269
00:50:56,950 --> 00:50:55,440
conflict i i think there has been a fair

1270
00:50:58,710 --> 00:50:56,960
amount of work on that a couple people

1271
00:51:01,750 --> 00:50:58,720
in the room here are on on a committee

1272
00:51:03,910 --> 00:51:01,760
that worked on on conflict uh management

1273
00:51:05,750 --> 00:51:03,920
uh especially when we're we're in normal

1274
00:51:07,349 --> 00:51:05,760
operations and then something goes wrong

1275
00:51:09,589 --> 00:51:07,359
i think that is part of the whole

1276
00:51:11,030 --> 00:51:09,599
operational procedure development and

1277
00:51:13,030 --> 00:51:11,040
the certification and operational

1278
00:51:14,950 --> 00:51:13,040
approval that hopefully when we've gone

1279
00:51:17,750 --> 00:51:14,960
through a lot of these committees and

1280
00:51:18,950 --> 00:51:17,760
and work and then actual trials and that

1281
00:51:20,069 --> 00:51:18,960
we end up

1282
00:51:21,750 --> 00:51:20,079
finding

1283
00:51:23,430 --> 00:51:21,760
most of those problems and hopefully

1284
00:51:24,870 --> 00:51:23,440
built it into the system

1285
00:51:27,030 --> 00:51:24,880
the other part of it is we're not taking

1286
00:51:28,630 --> 00:51:27,040
the controller out of the process so the

1287
00:51:30,710 --> 00:51:28,640
controller will be the one that will

1288
00:51:32,549 --> 00:51:30,720

will be responsible for stepping in if

1289
00:51:34,549 --> 00:51:32,559
if the controller sees something wrong

1290
00:51:36,470 --> 00:51:34,559
or if something is not the way it should

1291
00:51:38,069 --> 00:51:36,480
be so so i think there are multiple

1292
00:51:39,670 --> 00:51:38,079
levels in the process

1293
00:51:41,270 --> 00:51:39,680
ultimately i think brian talked a little

1294
00:51:43,430 --> 00:51:41,280
bit about ultimately having aircraft

1295
00:51:44,790 --> 00:51:43,440
self-separate a little further out but i

1296
00:51:46,870 --> 00:51:44,800
think that we have to go through all of

1297
00:51:48,390 --> 00:51:46,880
these other processes discover all those

1298
00:51:51,109 --> 00:51:48,400
things that you talked about before we

1299
00:51:53,670 --> 00:51:51,119
can take that final step

1300
00:51:57,190 --> 00:51:53,680
there's another

1301
00:51:59,510 --> 00:51:57,200
another area where excuse me

1302
00:52:01,510 --> 00:51:59,520
conflicting information is potentially

1303
00:52:02,950 --> 00:52:01,520
an issue and that is for the air traffic

1304
00:52:04,710 --> 00:52:02,960
controller

1305
00:52:06,309 --> 00:52:04,720
they have the

1306
00:52:08,470 --> 00:52:06,319
conventional radar data that they're

1307
00:52:11,109 --> 00:52:08,480
working with now the uh the fused radar

1308
00:52:13,510 --> 00:52:11,119
data and with adsb data coming in that's

1309
00:52:15,430 --> 00:52:13,520
much more accurate uh on the aircraft

1310
00:52:17,589 --> 00:52:15,440
that are broadcasting adhd there's the

1311
00:52:18,950 --> 00:52:17,599
challenge of being able to

1312
00:52:20,230 --> 00:52:18,960
integrate the

1313
00:52:22,150 --> 00:52:20,240

adsb

1314
00:52:23,990 --> 00:52:22,160
data

1315
00:52:25,030 --> 00:52:24,000
state information about aircraft

1316
00:52:26,150 --> 00:52:25,040
position

1317
00:52:29,430 --> 00:52:26,160
with the

1318
00:52:33,349 --> 00:52:29,440
non-broadcasting aircraft that are just

1319
00:52:34,470 --> 00:52:33,359
being detected using the um the radar uh

1320
00:52:36,150 --> 00:52:34,480
information

1321
00:52:37,829 --> 00:52:36,160
so there's a there's an interesting

1322
00:52:39,910 --> 00:52:37,839
integration challenge there and i don't

1323
00:52:41,349 --> 00:52:39,920
know if you're

1324
00:52:45,109 --> 00:52:41,359
i know that when we've conducted

1325
00:52:47,589 --> 00:52:45,119
simulations for us it's been um

1326
00:52:50,150 --> 00:52:47,599
uh

1327
00:52:51,589 --> 00:52:50,160
interesting to try to um to figure out

1328
00:52:53,349 --> 00:52:51,599
how to represent the two different types

1329
00:52:54,790 --> 00:52:53,359
of information to the uh to the

1330
00:52:56,870 --> 00:52:54,800
controller so that they can work with

1331
00:52:58,470 --> 00:52:56,880
them effectively

1332
00:53:03,589 --> 00:52:58,480
we have another another question out of

1333
00:53:06,710 --> 00:53:04,710
hi

1334
00:53:09,030 --> 00:53:06,720
i'm karen and i work with nasa

1335
00:53:10,630 --> 00:53:09,040
aeronautics and because i do i happen to

1336
00:53:12,950 --> 00:53:10,640
know that some of our aeronautics

1337
00:53:15,510 --> 00:53:12,960
scholarship recipients are watching

1338
00:53:17,510 --> 00:53:15,520

today online through nasa tv and they're

1339
00:53:20,549 --> 00:53:17,520
going to be checking out the podcast

1340
00:53:23,829 --> 00:53:20,559
and i think adsb is it's such a huge

1341
00:53:26,230 --> 00:53:23,839
issue it's so complex it's an incredible

1342
00:53:27,750 --> 00:53:26,240
system and looking you know for each one

1343
00:53:30,710 --> 00:53:27,760
of you and in particular the nasa

1344
00:53:32,549 --> 00:53:30,720
researchers i suppose

1345
00:53:34,950 --> 00:53:32,559
seeing the video and seeing the people

1346
00:53:36,549 --> 00:53:34,960
who are working in the simulation center

1347
00:53:37,910 --> 00:53:36,559
i just wondered if each one of you maybe

1348
00:53:40,630 --> 00:53:37,920
could just briefly

1349
00:53:42,950 --> 00:53:40,640
express what kinds of skills

1350
00:53:44,710 --> 00:53:42,960
the researchers are employing when

1351
00:53:46,870 --> 00:53:44,720
they're doing this kind of work you know

1352
00:53:48,390 --> 00:53:46,880
what kinds of people are working on

1353
00:53:51,270 --> 00:53:48,400
these issues obviously from the time

1354
00:53:52,549 --> 00:53:51,280
span that captain hill talked about

1355
00:53:54,230 --> 00:53:52,559
this is an issue

1356
00:53:55,990 --> 00:53:54,240
and it's not an issue that's going away

1357
00:53:57,750 --> 00:53:56,000
and it's going to be continued to be

1358
00:53:59,750 --> 00:53:57,760
tweaked and find solutions and then

1359
00:54:02,150 --> 00:53:59,760
tweak those solutions again

1360
00:54:03,430 --> 00:54:02,160
in the years to come so

1361
00:54:04,950 --> 00:54:03,440
what kinds of people are working on

1362
00:54:05,829 --> 00:54:04,960
these issues and what talents are they

1363
00:54:07,510 --> 00:54:05,839

using

1364
00:54:09,589 --> 00:54:07,520
thank you

1365
00:54:11,589 --> 00:54:09,599
i would say in general just about covers

1366
00:54:13,990 --> 00:54:11,599
the whole spectrum of

1367
00:54:15,030 --> 00:54:14,000
of aviation experience from having

1368
00:54:17,430 --> 00:54:15,040
people that are involved in the

1369
00:54:19,589 --> 00:54:17,440
operation that can put the problem down

1370
00:54:21,190 --> 00:54:19,599
and and then taking that to

1371
00:54:23,349 --> 00:54:21,200
actually developing solutions to that

1372
00:54:25,349 --> 00:54:23,359
problem so i think you're going to have

1373
00:54:27,270 --> 00:54:25,359
plenty of aeronautical engineers plenty

1374
00:54:29,670 --> 00:54:27,280
of operational experience people

1375
00:54:32,069 --> 00:54:29,680
controllers pilots um

1376
00:54:34,549 --> 00:54:32,079
the whole broad spectrum of everyone

1377
00:54:36,470 --> 00:54:34,559
that has to be involved in the solution

1378
00:54:38,710 --> 00:54:36,480
and and i think it's it's a wonderful

1379
00:54:40,950 --> 00:54:38,720
opportunity for for people to to take a

1380
00:54:42,950 --> 00:54:40,960
look but basically you have to have

1381
00:54:44,470 --> 00:54:42,960
obviously a fair amount of background in

1382
00:54:48,230 --> 00:54:44,480
aviation to

1383
00:54:51,430 --> 00:54:49,829
yeah i would say you know

1384
00:54:53,990 --> 00:54:51,440
both nancy and i have talked about a lot

1385
00:54:55,270 --> 00:54:54,000
of this development going on in

1386
00:54:57,030 --> 00:54:55,280
laboratories

1387
00:54:59,750 --> 00:54:57,040
most of that

1388
00:55:01,829 --> 00:54:59,760

is in simulation so it's all

1389
00:55:02,789 --> 00:55:01,839
computer-based so you know both of us

1390
00:55:05,190 --> 00:55:02,799
have

1391
00:55:06,789 --> 00:55:05,200
large teams at our centers that do

1392
00:55:09,510 --> 00:55:06,799
software development

1393
00:55:10,870 --> 00:55:09,520
so that's a a good avenue to get into

1394
00:55:14,470 --> 00:55:10,880
one of the interesting things i've

1395
00:55:16,230 --> 00:55:14,480
learned coming into this and um

1396
00:55:17,910 --> 00:55:16,240
not actually coming from an aeronautics

1397
00:55:21,109 --> 00:55:17,920
background

1398
00:55:23,190 --> 00:55:21,119
is that there really isn't any um

1399
00:55:25,190 --> 00:55:23,200
schooling set up for

1400
00:55:27,030 --> 00:55:25,200
working these types of problems so it's

1401
00:55:28,549 --> 00:55:27,040
actually is a nice

1402
00:55:31,510 --> 00:55:28,559
multi-disciplinary

1403
00:55:32,549 --> 00:55:31,520
team that develops um but you

1404
00:55:34,789 --> 00:55:32,559
basically

1405
00:55:37,510 --> 00:55:34,799
need to have the you know basic

1406
00:55:39,430 --> 00:55:37,520
engineering or scientific uh skills

1407
00:55:41,430 --> 00:55:39,440
being able to you know logically work

1408
00:55:43,589 --> 00:55:41,440
through the problems set up you know

1409
00:55:45,270 --> 00:55:43,599
experiments to get at what you're trying

1410
00:55:55,030 --> 00:55:45,280
to

1411
00:55:56,950 --> 00:55:55,040
picture in your mind

1412
00:55:58,069 --> 00:55:56,960
is important and i would just add that

1413
00:56:01,270 --> 00:55:58,079

you know because we're dealing with air

1414
00:56:04,150 --> 00:56:01,280
traffic services safety is king and and

1415
00:56:05,990 --> 00:56:04,160
the the safety analysis is is quite

1416
00:56:09,030 --> 00:56:06,000
complex and i think it takes a very

1417
00:56:11,270 --> 00:56:09,040
special skill set to to distill that

1418
00:56:14,549 --> 00:56:11,280
down to all the the things that have to

1419
00:56:16,950 --> 00:56:14,559
be considered in in developing standards

1420
00:56:19,349 --> 00:56:16,960
and and the requirements in order to

1421
00:56:21,349 --> 00:56:19,359
implement any system so i think that

1422
00:56:23,030 --> 00:56:21,359
requires a special skill set so if if

1423
00:56:24,549 --> 00:56:23,040
you're particularly adept at

1424
00:56:25,829 --> 00:56:24,559
knowing how to do that kind of safety

1425
00:56:26,950 --> 00:56:25,839
analyses i think that would be very

1426
00:56:28,789 --> 00:56:26,960
beneficial

1427
00:56:33,670 --> 00:56:28,799
all right we've got time for one more

1428
00:56:37,510 --> 00:56:35,030
i'll make it really quick then this is

1429
00:56:39,109 --> 00:56:37,520
probably for nancy uh the spacing model

1430
00:56:41,430 --> 00:56:39,119
that you showed and referred to i guess

1431
00:56:43,670 --> 00:56:41,440
you didn't show be referred to it if i

1432
00:56:45,990 --> 00:56:43,680
pop up convective unstable convective

1433
00:56:47,829 --> 00:56:46,000
weather in that model i imagine from a

1434
00:56:50,549 --> 00:56:47,839
research standpoint that makes it much

1435
00:56:52,470 --> 00:56:50,559
more complex can you give us an idea of

1436
00:56:53,750 --> 00:56:52,480
like what that complexity is or hope

1437
00:56:55,750 --> 00:56:53,760
that

1438
00:56:57,589 --> 00:56:55,760

research will lead to whether or not

1439
00:56:58,710 --> 00:56:57,599
having quite the drastic effect it has

1440
00:57:01,349 --> 00:56:58,720
now on

1441
00:57:02,230 --> 00:57:01,359
traffic delays

1442
00:57:04,390 --> 00:57:02,240
um

1443
00:57:07,109 --> 00:57:04,400
boy i'm not the first to take that

1444
00:57:09,190 --> 00:57:07,119
question but

1445
00:57:14,309 --> 00:57:09,200
i'm

1446
00:57:16,230 --> 00:57:14,319
we do the studies in our lab i could i

1447
00:57:18,309 --> 00:57:16,240
could uh

1448
00:57:19,829 --> 00:57:18,319
tell you that um

1449
00:57:21,589 --> 00:57:19,839
from my perspective one of the

1450
00:57:24,069 --> 00:57:21,599
challenges there would be

1451
00:57:27,190 --> 00:57:24,079
being able to uh effectively reroute

1452
00:57:29,510 --> 00:57:27,200
around that confective weather and to to

1453
00:57:31,990 --> 00:57:29,520
try to be able to maintain that that

1454
00:57:35,270 --> 00:57:32,000
stream of aircraft who are self-spacing

1455
00:57:37,109 --> 00:57:35,280
now i think and and i can visualize how

1456
00:57:38,470 --> 00:57:37,119
the controller tools could be could be

1457
00:57:39,750 --> 00:57:38,480
used to do that

1458
00:57:41,270 --> 00:57:39,760
um

1459
00:57:43,109 --> 00:57:41,280
i

1460
00:57:46,150 --> 00:57:43,119
know less about

1461
00:57:47,670 --> 00:57:46,160
how it would work from the flight deck

1462
00:57:49,349 --> 00:57:47,680
perspective though and and you may have

1463
00:57:50,630 --> 00:57:49,359

given this some thought

1464
00:57:52,150 --> 00:57:50,640
i think there's a whole lot of work

1465
00:57:54,549 --> 00:57:52,160
going in that area

1466
00:57:56,470 --> 00:57:54,559
our ultimate goal is as nancy said is to

1467
00:57:58,630 --> 00:57:56,480
to re-rerout ourselves around any

1468
00:58:00,230 --> 00:57:58,640
thunderstorms that are there uh the

1469
00:58:01,589 --> 00:58:00,240
obvious problem if there's thunderstorms

1470
00:58:03,109 --> 00:58:01,599
or snow storms on an airport you're

1471
00:58:04,870 --> 00:58:03,119
going to affect that airport but there's

1472
00:58:06,549 --> 00:58:04,880
plenty of airspace out there so if you

1473
00:58:08,150 --> 00:58:06,559
put together all the technologies that

1474
00:58:09,829 --> 00:58:08,160
are working being worked on the

1475
00:58:11,829 --> 00:58:09,839
navigation communication and

1476
00:58:12,950 --> 00:58:11,839
surveillance and the ground tools to

1477
00:58:15,430 --> 00:58:12,960
support that

1478
00:58:18,309 --> 00:58:15,440
you can basically dynamically reroute

1479
00:58:19,910 --> 00:58:18,319
the aircraft using datalink and and and

1480
00:58:21,510 --> 00:58:19,920
still have the aircraft be able to space

1481
00:58:22,870 --> 00:58:21,520
off of each other as long as they all

1482
00:58:25,349 --> 00:58:22,880
have the information about what the

1483
00:58:27,270 --> 00:58:25,359
other aircraft is doing so so i i think

1484
00:58:29,510 --> 00:58:27,280
it's that integration has to occur and i

1485
00:58:31,030 --> 00:58:29,520
i would personally like to see more work

1486
00:58:33,190 --> 00:58:31,040
done in integration of all these

1487
00:58:34,870 --> 00:58:33,200
technologies and that implementation of

1488
00:58:37,190 --> 00:58:34,880

that yeah and i guess one thing that i

1489
00:58:38,950 --> 00:58:37,200
could say to that too is that we're

1490
00:58:41,430 --> 00:58:38,960
one of the the other simulations we're

1491
00:58:43,990 --> 00:58:41,440
working on now in our lab looks at how

1492
00:58:46,789 --> 00:58:44,000
you could actually uh reroute a a

1493
00:58:47,750 --> 00:58:46,799
cluster of aircraft

1494
00:58:50,710 --> 00:58:47,760
on

1495
00:58:54,150 --> 00:58:50,720
the same modified trajectory so if you

1496
00:58:56,870 --> 00:58:54,160
had the information about where the um

1497
00:58:58,950 --> 00:58:56,880
where the the clear path was you could

1498
00:59:00,309 --> 00:58:58,960
conceivably reroute all of those planes

1499
00:59:02,950 --> 00:59:00,319
and they could maintain their cell

1500
00:59:04,950 --> 00:59:02,960
spacing status on that on that new

1501
00:59:06,230 --> 00:59:04,960
modified routing

1502
00:59:07,990 --> 00:59:06,240
all right that's going to have to be our

1503
00:59:10,470 --> 00:59:08,000
last question we've had a really great

1504
00:59:12,710 --> 00:59:10,480
discussion today but we're out of time

1505
00:59:14,950 --> 00:59:12,720
on behalf of associate administrator

1506
00:59:17,990 --> 00:59:14,960
jaywan shin and nasa thanks to our

1507
00:59:20,870 --> 00:59:18,000
guests robert novia of the faa bob hilb

1508
00:59:23,270 --> 00:59:20,880
of ups and our two nasa researchers

1509
00:59:25,510 --> 00:59:23,280
nancy smith and brian barmore you can

1510
00:59:28,230 --> 00:59:25,520
learn more about automatic dependent

1511
00:59:29,430 --> 00:59:28,240
surveillance broadcast or adsb and

1512
00:59:32,309 --> 00:59:29,440
nasa's

1513
00:59:34,470 --> 00:59:32,319

research on airborne precisions facing

1514
00:59:36,549 --> 00:59:34,480
by visiting nasa's website we've

1515
00:59:38,950 --> 00:59:36,559
provided copies of the charts and videos

1516
00:59:41,430 --> 00:59:38,960
used in today's discussion and several

1517
00:59:44,309 --> 00:59:41,440
technical papers that are detailing this

1518
00:59:46,309 --> 00:59:44,319
research and this is a very long url

1519
00:59:50,549 --> 00:59:46,319
we'll show it to you in a minute but if

1520
00:59:54,870 --> 00:59:52,870
and look for the leading edge icon click

1521
00:59:57,030 --> 00:59:54,880
on that and you'll be able to find all

1522
00:59:59,109 --> 00:59:57,040
of this information and we do invite

1523
01:00:01,270 --> 00:59:59,119
members of our audience to sign up for

1524
01:00:03,589 --> 01:00:01,280
our email notices the sign up sheet is

1525
01:00:05,589 --> 01:00:03,599
on the table just outside in the hallway