1
00:00:12,812 --> 00:00:16,383
consider major aeronautical
revolutions a few may come to
mind

2
00:00:17,850 --> 00:00:20,453
for example the first
flight at Kitty Hawk

3
00:00:22,488 --> 00:00:25,558
or breaking the sound
barrier at Edwards

4
00:00:26,625 --> 00:00:29,628
or perhaps the massive build-up
that led to humans leaving

5
00:00:29,628 --> 00:00:33,232
Earth to explore other
planetary bodies

6
00:00:33,232 --> 00:00:38,938
while these achievements are
extraordinary one key
aeronautical revolution that is

7
00:00:38,938 --> 00:00:42,809
often overlooked is the
standardization of commercial
flights into the National

8
00:00:42,809 --> 00:00:45,010
Airspace or NAS

9
00:00:46,045 --> 00:00:49,115
it may seem simple enough and
often not widely understood

10
00:00:49,115 --> 00:00:55,388
by the flying public but our

national airspace infrastructure
is huge

11
00:00:55,388 --> 00:01:00,359
it comprises the navigation
facilities and airports of the
United States

12
00:01:00,359 --> 00:01:07,000
and all the services, rules,
regulations, policies,
procedures, personnel and
equipment

13
00:01:07,000 --> 00:01:09,669
everyday more than
44,000 flights

14
00:01:09,669 --> 00:01:12,472
safely takeoff and
land here in the US

15
00:01:12,472 --> 00:01:16,141
totaling more than 16
million flights per year

16
00:01:16,141 --> 00:01:19,312
this process is
seamless to most of us

17
00:01:19,312 --> 00:01:23,282
due to the dedication of
millions of professionals who
work to provide safe

18
00:01:23,282 --> 00:01:25,585
flights in and out of
the national airspace

19
00:01:25,952 --> 00:01:29,488
when a complex system this big

20
00:01:29,488 --> 00:01:33,460
works so seamlessly, great care
must be taken when new
advancements are added into it

21
00:01:35,395 --> 00:01:38,898
over the years there have been
incremental changes to the
system

22
00:01:38,898 --> 00:01:42,068
but one major advancement
that is happening now

23
00:01:42,068 --> 00:01:44,937
is the integration of
unmanned aircraft systems

24
00:01:44,937 --> 00:01:46,672
into the national airspace

25
00:01:47,273 --> 00:01:49,608
that may sound innocuous enough

26
00:01:50,409 --> 00:01:53,246
but updating our current
national airspace to include
millions of

27
00:01:54,414 --> 00:01:57,550
unmanned aircraft
is a Herculean task

28
00:01:57,550 --> 00:02:01,421
that has required years
of research, study

29
00:02:01,421 --> 00:02:05,825
and countless hours of design

and analysis to move this task
forward

30
00:02:05,825 --> 00:02:07,893
this integration
needs to be seamless

31
00:02:07,893 --> 00:02:09,129
keeping the flying public safe

32
00:02:10,596 --> 00:02:13,800
while also allowing new vehicles
to perform their assigned tasks

33
00:02:17,236 --> 00:02:23,142
on this episode of NASAX we'll
follow researchers from NASA and
Industry to

34
00:02:23,142 --> 00:02:26,245
better understand how unmanned
aircraft systems will be
integrated into the

35
00:02:26,245 --> 00:02:28,447
National Airspace System

36
00:02:28,447 --> 00:02:31,183
we will also shadow a
unique flight test

37
00:02:31,183 --> 00:02:35,721
that joins pilots, engineers and
researchers together to help
establish

38
00:02:35,721 --> 00:02:38,725
standards for piloted and
unmanned aircraft flying in the
NAS

39
00:02:40,793 --> 00:02:45,564
join us as we uncover this
complex endeavor andfind out
what the future of flight looks

40
00:02:45,564 --> 00:02:49,536
like for UAS consumers
in the flying public

41
00:02:50,369 --> 00:03:06,419
[music]

42
00:03:17,763 --> 00:03:19,632
on this cold morning in
California's high desert

43
00:03:20,967 --> 00:03:24,136
a group of researchers from
NASA and from industry

44
00:03:24,136 --> 00:03:27,606
are preparing for another
fact-finding flight using the

45
00:03:27,606 --> 00:03:31,678
NAVMAR Applied
Sciences TigerShark XP

46
00:03:31,678 --> 00:03:34,847
NASA Armstrong located at
Edwards Air Force Base

47
00:03:34,847 --> 00:03:38,952
has seen many important test
flights over the years

48
00:03:41,321 --> 00:03:46,392
but this flight and the others
performed by this group are
being used as building blocks

49
00:03:46,392 --> 00:03:49,429
for research that is enabling a paradigm shift in flight as we know it

50
00:03:54,634 --> 00:03:59,772
this round of testing known as flight test series six or FT6

51
00:03:59,772 --> 00:04:04,177
is assisting the Federal Aviation Administration as they develop

52
00:04:04,177 --> 00:04:07,980
regulations to allow the integration of unmanned aircraft systems into the

53
00:04:07,980 --> 00:04:09,515
National Airspace System

54
00:04:11,617 --> 00:04:14,486
so the work that we're doing will contribute

55
00:04:14,486 --> 00:04:19,825
for others to come after us and know how to safely integrate this type of airplane

56
00:04:19,825 --> 00:04:24,964
into the national airspace so a lot has gone on to integrate manned

57
00:04:24,964 --> 00:04:29,969
airplane into different parts of the airspace so the same level of effort or

58
00:04:29,969 --> 00:04:35,908
perhaps more needs to go into
integrated non unmanned
airplanes

59
00:04:35,908 --> 00:04:40,579
there's different options on how
you do that, there could be a
pilot on the ground just what
we're

60
00:04:40,579 --> 00:04:46,185
doing right now or the airplane
could be doing things on its own
before you let

61
00:04:46,185 --> 00:04:51,623
the airplane go do things on its
own we would need to be able to
anticipate all

62
00:04:51,623 --> 00:04:54,861
the sorts of things it can see
and you know how it would safely
respond to those things

63
00:04:56,629 --> 00:05:00,299
so the work that we're doing
will eventually help get us
there

64
00:05:00,299 --> 00:05:05,237
whether we have a pilot on the
ground either monitoring or
actively

65
00:05:05,237 --> 00:05:10,543
controlling the unmanned
airplane or if the unmanned
airplane can do something

66
00:05:10,543 --> 00:05:14,513
on its own that, whatever it
does, will be safe to the
traffic around it

67
00:05:14,513 --> 00:05:16,382
and to the people under it

68
00:05:44,577 --> 00:05:47,547
unmanned aircraft have come a
long way over the past several
decades

69
00:05:49,081 --> 00:05:51,617
once they were relegated to toy
status and for military use

70
00:05:53,486 --> 00:05:57,323
but now there are many different
applications for UAS use being
studied

71
00:05:57,323 --> 00:05:58,891
like package delivery

72
00:06:00,192 --> 00:06:01,594
helping with crop production

73
00:06:03,062 --> 00:06:05,331
disaster relief

74
00:06:05,331 --> 00:06:06,599
and even transporting people

75
00:06:08,734 --> 00:06:13,839
with this increase in UAS
numbers, the FAA realized that
integrating these

76

00:06:13,839 --> 00:06:18,343
remote controlled and autonomous
aircraft needs to be prioritized

77
00:06:18,343 --> 00:06:24,516
well NASA has a dual purpose in
this one is to do the basic
research that is

78
00:06:24,516 --> 00:06:30,589
required to understand what is
needed to integrate the UAS into
the NAS and to

79
00:06:30,589 --> 00:06:34,993
help us do the early research to
determine what are the
regulations that are needed

80
00:06:34,993 --> 00:06:38,730
the policies, the guidelines,
those types of things

81
00:06:38,730 --> 00:06:43,202
and what's the information we
need in order to issue waivers
and certifications and those
things

82
00:06:43,202 --> 00:06:48,674
at the same time they also have
a responsibility or a goal to
assist

83
00:06:48,674 --> 00:06:53,645
industry and letting them know
what's necessary for them to
produce and

84
00:06:53,645 --> 00:06:56,783
operate UAS's is in
the national airspace

85
00:06:56,783 --> 00:07:00,185
so with the help of NASA
and the aviation industry

86
00:07:00,185 --> 00:07:04,657
new small, lightweight
and low powered sensors to help

87
00:07:04,657 --> 00:07:09,995
conventional aircraft and UAVs
detect and avoid one another are
being evaluated

88
00:07:09,995 --> 00:07:15,334
the FAA it has a mandate
obviously to to make sure that
we have

89
00:07:15,334 --> 00:07:21,240
air space that's safe, but also
that they enable the utilization
of aircraft and

90
00:07:21,240 --> 00:07:24,811
technologies that really benefit
the American public and it's
clear there's

91
00:07:24,811 --> 00:07:30,716
a lot of industry pull for the
FAA to come up with rulemaking
and some

92
00:07:30,716 --> 00:07:34,887
standards that would enable some
of these newer platforms these
newer use cases

93
00:07:34,887 --> 00:07:40,526
and so if there...turns out

there's a use case for
delivering a pizza

94
00:07:40,526 --> 00:07:43,962
we want to make sure that the
FAA has come up with a way to do
that safely

95
00:07:43,962 --> 00:07:49,535
if there's a use case to get
your birthday present delivered
to your front door by

96
00:07:49,535 --> 00:07:53,372
an unmanned vehicle we want to
make sure that the FAA has
enough information to

97
00:07:53,372 --> 00:07:57,810
to really be able to allow a
company to do that safely and so
these

98
00:07:57,810 --> 00:08:02,514
demonstrations were really meant
to look at those enabling
technologies

99
00:08:02,514 --> 00:08:05,884
figure out maybe what the
pitfalls and what some of the
limitations are but

100
00:08:05,884 --> 00:08:09,889
ultimately to inform the FAA so
that they can do the rulemaking
that's needed

101
00:08:09,889 --> 00:08:10,890
that will really open up
some of these markets

102
00:08:17,496 --> 00:08:23,668
so detect and avoid in
particular manned pilots have a
responsibility to see and avoid

103
00:08:23,668 --> 00:08:27,606
other aircraft when they're
flying in the airspace and when
you take the pilot and

104
00:08:27,606 --> 00:08:30,842
put them remotely in a ground
control station we still have
that

105
00:08:30,842 --> 00:08:36,582
responsibility and so pilots
need to, we need to use other
sensors to detect

106
00:08:36,582 --> 00:08:40,753
other aircraft and then develop
algorithms to help them
determine how to

107
00:08:40,753 --> 00:08:43,088
avoid those over aircraft

108
00:08:43,088 --> 00:08:47,093
as Jay mentioned, one
of the primary safety

109
00:08:47,093 --> 00:08:50,062
concerns with integrating these
new systems is the inability of
remote

110
00:08:50,062 --> 00:08:52,698
operators to see and avoid other
aircraft

111
00:08:54,466 --> 00:08:57,103
on all flights with
pilots on board

112
00:08:57,103 --> 00:09:01,173
the FAA requires the crew to be
aware of all other surrounding
aircraft

113
00:09:01,173 --> 00:09:04,110
either visually or using onboard
instrumentation

114
00:09:05,878 --> 00:09:08,548
in addition to instruments, the
pilot physically looks out the
window

115
00:09:09,648 --> 00:09:13,185
to help safely avoid
other aircraft

116
00:09:13,185 --> 00:09:16,789
because unmanned aircraft
literally don't have a pilot on
board

117
00:09:16,789 --> 00:09:21,159
NASA and its partners have been
working on concepts and designs
that will allow

118
00:09:21,159 --> 00:09:24,196
safe operation
within the national airspace

119
00:09:29,668 --> 00:09:33,072
that is where ft6 comes in

120
00:09:33,072 --> 00:09:35,975

since 2011, NASA has
incrementally been evaluating

121
00:09:37,510 --> 00:09:42,815
how to help remote pilots safely
detect and avoid other aircraft

122
00:09:42,815 --> 00:09:48,320
by systematically testing and
developing new concepts and
standards

123
00:09:48,320 --> 00:09:53,225
from the very beginning, of
course, the first thing was to
essentially integrate the
payload

124
00:09:53,225 --> 00:09:56,729
which is the detect and avoid
system into the aircraft

125
00:09:56,729 --> 00:10:00,967
once we did that, then we go
through a series of system
checkout flights

126
00:10:02,267 --> 00:10:04,236
just to make sure
everything is working

127
00:10:04,236 --> 00:10:07,506
whatever we learn from that
in terms of from a safety

128
00:10:07,506 --> 00:10:10,976
standpoint also from a
functionality standpoint that we
make corrections and

129
00:10:10,976 --> 00:10:12,911

basically improve on that

130
00:10:12,911 --> 00:10:15,881
once we verify that
the system is working

131
00:10:15,881 --> 00:10:22,387
then the next step is to
essentially introduce intruder
aircraft to verify

132
00:10:22,387 --> 00:10:26,625
that the displays and the
alerting guidance systems work
and get feedback from the pilots
as

133
00:10:26,625 --> 00:10:30,529
well and those rehearsals
basically are to set up for what
we call the full

134
00:10:30,529 --> 00:10:33,632
mission which is where we are
right now, in that phase

135
00:10:33,632 --> 00:10:36,868
in this final phase of FT6

136
00:10:36,868 --> 00:10:41,373
NASA and its partners will be
working to support development
of minimum

137
00:10:41,373 --> 00:10:46,312
operational performance
standards or MOPS for detect and
avoid for

138
00:10:46,312 --> 00:10:52,685
medium-sized UAS's is utilizing

small lightweight and low power
sensors

139
00:10:52,685 --> 00:10:57,956
from our side we're pushing the
boundaries for for these small
aircraft

140
00:10:57,956 --> 00:11:02,394
we're trying to fly a radar
that's small, tiny... and trying
to pick up aircraft and

141
00:11:02,394 --> 00:11:06,165
they're trying to define what
that is... again it's a brand
new radar

142
00:11:06,165 --> 00:11:10,936
state-of-the-art systems, they
don't really exist out there,
low soft systems

143
00:11:10,936 --> 00:11:14,273
don't really exist for
aircraft...when you're dealing
with smaller aircraft a lot

144
00:11:14,273 --> 00:11:19,078
of its hobby-grade type of
systems...avionics...a lot of it

145
00:11:19,078 --> 00:11:24,717
is not conducted to flying real
aircraft but now that we
actually trying to fly in

146
00:11:24,717 --> 00:11:28,520
the National Airspace we need to
put real avionics on there,
things that are

147
00:11:28,520 --> 00:11:32,324
tested to FAA certification and
that's pushing the boundary that
I think that's

148
00:11:32,324 --> 00:11:34,160
what we're doing here with this
low swap system

149
00:11:37,463 --> 00:11:40,733
so how is the NASA team
pushing the boundaries

150
00:11:40,733 --> 00:11:45,003
by using a number of unique
control centers, piloted
aircraft

151
00:11:45,003 --> 00:11:48,941
and a UAS with a large number of
flight hours to supply the
needed information

152
00:11:48,941 --> 00:11:54,180
for integration

153
00:12:20,839 --> 00:12:25,877
FT6 is a multi-dimensional test
with many different groups of
researchers and

154
00:12:25,877 --> 00:12:32,217
pilots working together to make
sure the test goes according to
plan

155
00:12:32,217 --> 00:12:36,088
during each flight there are
several different researchers in
different control rooms

156
00:12:36,088 --> 00:12:39,958
monitoring the flight and there
are also at least three layers
of pilots in the

157
00:12:39,958 --> 00:12:41,460
air and on the ground

158
00:12:44,329 --> 00:12:48,968
to better understand this
complex dance let's first look
at the UAS that is being used

159
00:12:50,168 --> 00:12:52,637
for this round of
testing, NASA decided

160
00:12:52,637 --> 00:12:56,375
to use the NAVMAR Applied
Sciences Tigershark XP UAS

161
00:12:59,110 --> 00:13:05,985
this is a medium-sized aircraft
with a wingspan of nearly 22
feet and can stay aloft for 12
hours

162
00:13:07,653 --> 00:13:12,757
it's controlled remotely using a
ground-based cockpit and has
been

163
00:13:12,757 --> 00:13:17,095
equipped with a smoke generating
system to assist the intruder
pilot with

164
00:13:17,095 --> 00:13:21,567
visibility and an early
developmental low swap nose
mounted radar

165
00:13:21,567 --> 00:13:24,870
built by Honeywell, that
will use a fixed phase array

166
00:13:24,870 --> 00:13:28,006
to steer the radar
beam electronically

167
00:13:28,006 --> 00:13:32,444
the tiger shark is a group
three, unmanned aerial vehicle
500 pound weight class

168
00:13:32,444 --> 00:13:38,050
and it has been used as
basically an R&D platform to
enable

169
00:13:38,050 --> 00:13:46,458
NASA and NASA's partners to test
various pieces of software and
hardware to help

170
00:13:46,458 --> 00:13:52,431
develop standard operating
procedures for integrating UAS
into the National Airspace

171
00:13:52,431 --> 00:13:55,701
relative to detect and avoid
technology component

172
00:13:55,701 --> 00:13:57,770
because this UAS platform

173
00:13:57,770 --> 00:14:03,609
has such a long and stable track
record the FT6 team felt that

174

00:14:03,609 --> 00:14:07,679
its reliability would allow them
to focus their expertise on
testing rather

175
00:14:07,679 --> 00:14:10,416
than worrying about building
their own UAS

176
00:14:10,416 --> 00:14:13,952
one of the most
intriguing aspects

177
00:14:13,952 --> 00:14:17,056
of this test is the different
roles and assignments performed
by the team flying the UAS

178
00:14:21,860 --> 00:14:26,632
the NAVMAR team pilots the
aircraft during the initial
takeoff and

179
00:14:26,632 --> 00:14:30,802
landing phase, but after the
craft is airborne control of the
UAS

180
00:14:30,802 --> 00:14:32,937
is handed off to NASA pilots

181
00:14:32,937 --> 00:14:37,075
the subject pilots that take
over the flight are not aware

182
00:14:37,075 --> 00:14:40,412
of when intrusions into the
airspace would occur making it
realistic to what

183
00:14:40,412 --> 00:14:42,614

pilots in the NAS
would experience

184
00:14:42,614 --> 00:14:46,952
[traffic management radio]

185
00:14:48,587 --> 00:14:53,792
Operator: Open center NASA01
clear conflict heading 030

186
00:14:53,792 --> 00:14:57,429
they must be able to react
quickly without anticipating a
solution to a scenario

187
00:14:57,429 --> 00:15:00,198
before the encounter
has even occurred

188
00:15:00,198 --> 00:15:02,701
this is a subject
pilot station so what

189
00:15:02,701 --> 00:15:07,039
they're observing is the the own
ship aircraft and they'll see

190
00:15:07,039 --> 00:15:12,610
intruder aircraft...the aircraft
are generated by either
virtually from Ames

191
00:15:12,610 --> 00:15:16,448
and that's just to add it
background traffic, but to kind
of create a real

192
00:15:16,448 --> 00:15:22,087
airspace system and then you
have a real traffic that's
picked up by the aircraft

193
00:15:22,087 --> 00:15:26,191
systems and that's injected
through the payload and it comes
into the system too

194
00:15:26,191 --> 00:15:30,996
so they're getting a mix of both
real traffic and virtual traffic
and all

195
00:15:30,996 --> 00:15:35,200
they're doing is essentially
flying this mission, they'll get
intruders coming in

196
00:15:35,200 --> 00:15:39,972
and causing traffic alerts,
that's a yellow alert...they'll
either talk to ATC

197
00:15:39,972 --> 00:15:44,877
and move, but if it's a red
alert they'll move immediately
then talk to ATC and

198
00:15:44,877 --> 00:15:49,381
coordinate on the way
back...this is all done in
Oakland airspace in a virtual

199
00:15:49,381 --> 00:15:53,685
environment...from their side
even though they're flying the
real aircraft with real
intruders

200
00:15:53,685 --> 00:15:57,989
we were actually able to gather
a lot of the metrics that you

201

00:15:57,989 --> 00:16:02,127
would normally gather in a lab
but in this case a real
atmospheric flight and

202
00:16:02,127 --> 00:16:06,398
that's what we call live,
virtual and constructive, we had
the live component

203
00:16:06,398 --> 00:16:11,836
which is the live UAS and the
live intruder; the constructive,
which were

204
00:16:11,836 --> 00:16:16,341
traffic simulated aircraft that
we're moving in the airspace and
in virtual

205
00:16:16,341 --> 00:16:20,545
which were actually people who
were flying a simulated aircraft
and talking

206
00:16:20,545 --> 00:16:23,782
over the radio and all
those things combined

207
00:16:23,782 --> 00:16:26,452
to create a really
immersive test environment

208
00:16:26,452 --> 00:16:32,290
so this is the mobile
operations facility, MOF 5

209
00:16:32,290 --> 00:16:35,327
so this is the NASA ground
control station... this is where
we execute all the flight
testing

210
00:16:37,463 --> 00:16:43,335
all the missions conducted from
this, so the systems interface
to the NAVMAR ground station

211
00:16:43,335 --> 00:16:47,005
it's interfaced to the LBC
environment and its interfaced
to the

212
00:16:47,005 --> 00:16:52,077
comm system here at
Armstrong...uh, so interfaces to
all the systems and

213
00:16:52,077 --> 00:16:56,148
it allows us to communicate
with everything so from here

214
00:16:56,148 --> 00:17:00,352
once the aircraft's airborne our
pilots take control of the
aircraft

215
00:17:00,352 --> 00:17:06,291
move it into the airspace and
then after that control is
transferred to the

216
00:17:06,291 --> 00:17:09,594
subject pilot that's on this
side of the station and that's
where we conduct the

217
00:17:09,594 --> 00:17:12,431
mission, the full mission
for the flight test

218
00:17:12,431 --> 00:17:15,833
so the subject pilot is not

familiar with the system

219
00:17:15,833 --> 00:17:20,672
to try...and that's done on
purpose as a human factors
research

220
00:17:20,672 --> 00:17:23,542
we need trained pilots to
actually monitor the airspace
and in an

221
00:17:23,542 --> 00:17:26,979
and make sure that there's some
room... we're still flying in
real airspace

222
00:17:26,979 --> 00:17:31,649
and actual Edwards Air Force
Base there's actually other
missions going on in the

223
00:17:31,649 --> 00:17:36,021
background so we need our pilots
has to manage that part of the
test

224
00:17:36,021 --> 00:17:38,623
and call it off if they need to
or or take control of the
aircraft

225
00:17:38,623 --> 00:17:40,725
if there's an actual emergency
up in the air

226
00:17:40,725 --> 00:17:42,094
or there's another
mission that's intruding

227
00:17:45,497 --> 00:17:49,835

these piloted aircraft are not
only employed as chase planes

228
00:17:49,835 --> 00:17:53,305
but are used to intrude in
the airspace around the UAS

229
00:17:53,305 --> 00:17:56,508
to test the detect
and avoid system

230
00:17:56,508 --> 00:17:57,643
during these flights
intruder aircraft

231
00:17:59,644 --> 00:18:04,382
intentionally fly very close
passing encounters to the UAS
which trigger the

232
00:18:04,382 --> 00:18:07,052
DAA, a landing and guidance

233
00:18:07,052 --> 00:18:11,056
these encounters test the
detect and avoid procedures

234
00:18:11,056 --> 00:18:14,326
helping researchers develop
performance standards to address
such scenarios

235
00:18:35,146 --> 00:18:38,016
a typical test day
starts off in the

236
00:18:38,016 --> 00:18:44,088
early morning hours, the team
starts with a T0 briefing during
this time all team

237
00:18:44,088 --> 00:18:48,827
members go over all the test parameters for the day once that briefing is

238
00:18:48,827 --> 00:18:53,331
complete everyone goes to their respective locations such as control

239
00:18:53,331 --> 00:18:56,935
rooms or to the aircraft when everyone is ready there is a comm check over a

240
00:18:56,935 --> 00:19:01,439
specific frequency

241
00:19:01,439 --> 00:19:05,743
meanwhile the TigerShark is towed out to the lake bed for launch

242
00:19:05,743 --> 00:19:11,483
while the intruder aircraft are preparing for takeoff

243
00:19:24,062 --> 00:19:28,600
once on the lakebed, a series of tests are performed on the aircraft to ensure

244
00:19:28,600 --> 00:19:34,306
it is safe and ready to fly

245
00:19:34,306 --> 00:19:37,976
when all these tests are complete the ready call

246
00:19:37,976 --> 00:19:42,915

is given and the aircraft
is set for takeoff

247
00:19:55,860 --> 00:19:58,797
Radio call: ...and, we've got
good RPM's, good systems, fresh
off

248
00:20:09,841 --> 00:20:14,979
on this cold clear
morning the aircraft

249
00:20:14,979 --> 00:20:17,416
takes flight without a problem,
to begin the day's test

250
00:20:19,984 --> 00:20:23,322
once airborne the NAVMAR team

251
00:20:23,322 --> 00:20:27,025
hands over control to the test
pilots to fly the mission for
the day

252
00:20:27,025 --> 00:20:29,627
Radio call: Pilot, this is AVP
on mission ready for handover

253
00:20:29,627 --> 00:20:32,598
Pilot: pilot ready for handover

254
00:20:35,233 --> 00:20:36,535
Pilot: pilot has the aircraft

255
00:20:37,902 --> 00:20:40,805
In the various control
rooms, teams of researchers

256
00:20:40,805 --> 00:20:43,674
are monitoring the system while

intruder aircrafts begin the

257
00:20:43,674 --> 00:20:45,611
incursions into the UAS airspace

258
00:20:46,544 --> 00:20:52,251
[radio communication]

259
00:20:54,185 --> 00:20:58,189
on this day each pilot sees the
incursions and properly guides
the

260
00:20:58,189 --> 00:21:02,427
aircraft away from the intruders

261
00:21:02,427 --> 00:21:06,197
this test continued for
several hours with

262
00:21:06,197 --> 00:21:11,136
numerous intrusions occurring,
as the test winds down flight
control is given

263
00:21:11,136 --> 00:21:14,773
back to the NAVMAR team who then
brings the TigerShark back for a
perfect landing

264
00:21:22,313 --> 00:21:29,520
when I first started,
quadcopters or large UAS weren't
really

265
00:21:29,520 --> 00:21:34,826
a thing and now we've flown a
large UAS in the national
airspace for the

266

00:21:34,826 --> 00:21:39,197
first time and now we're working
towards integrating smaller
class UAS into the

267
00:21:39,197 --> 00:21:40,666
national airspace as well

268
00:21:42,767 --> 00:21:46,371
eventually everybody
wants to jump in a

269
00:21:46,371 --> 00:21:50,041
taxi and have it airlift you
from building to building

270
00:21:50,041 --> 00:21:52,044
this technology, this
detect avoid technology

271
00:21:52,044 --> 00:21:57,248
will really help...help
that and conduct it safely

272
00:21:57,248 --> 00:22:03,288
over the course of this
comprehensive testing, NASA and
the FAA have amassed an

273
00:22:03,288 --> 00:22:07,225
enormous amount of data allowing
safe efficient integration of
these systems

274
00:22:07,225 --> 00:22:10,328
into the National Airspace

275
00:22:10,328 --> 00:22:13,431
this type of result is not
unusual for NASA and its
partners

276
00:22:13,431 --> 00:22:18,303
over the past 60 years this
organization has continued to
push the

277
00:22:18,303 --> 00:22:20,572
boundaries in science,
engineering and technology

278
00:22:24,209 --> 00:22:27,211
while the presence of drones
and unmanned aircraft

279
00:22:27,211 --> 00:22:31,850
begins to populate the skies,
NASA will continue to test,

280
00:22:31,850 --> 00:22:36,187
evaluate and pursue a safe and
efficient air space that will
coexist with

281
00:22:36,187 --> 00:22:38,456
commercial and private aircraft

282
00:22:38,456 --> 00:22:41,560
what many thought
was science fiction

283
00:22:41,560 --> 00:22:44,296
will soon become science fact
as these aircraft