**DR. DAVID DINGES**

PRINCIPAL INVESTIGATOR,
REACTION SELF TEST
UNIV. OF PENNSYLVANIA
PERELMAN SCHOOL OF MEDICINE

1
00:00:08,870 --> 00:00:06,789
so the international space station a

2
00:00:10,950 --> 00:00:08,880
very unique environment for men and

3
00:00:13,110 --> 00:00:10,960
women to work very unique laboratory up

4
00:00:14,709 --> 00:00:13,120
uh operating in microgravity around the

5
00:00:16,950 --> 00:00:14,719
clock and can be a little stressful

6
00:00:18,310 --> 00:00:16,960
sometimes and uh we always have to be

7
00:00:19,670 --> 00:00:18,320
mindful of the crew's health to make

8
00:00:22,150 --> 00:00:19,680
sure they're operating at peak

9
00:00:23,750 --> 00:00:22,160
efficiency and there's one study that's

10
00:00:25,189 --> 00:00:23,760
been taking place over the past couple

11
00:00:27,109 --> 00:00:25,199
of years and is getting some special

12
00:00:29,029 --> 00:00:27,119
focus during the one-year mission with

13
00:00:31,669 --> 00:00:29,039

scott kelly mikhail kornenko called the

14
00:00:33,750 --> 00:00:31,679
reaction self-test and to learn a little

15
00:00:36,229 --> 00:00:33,760
bit more about it today i'm joined by dr

16
00:00:38,709 --> 00:00:36,239
david dinges who's the chief of the unit

17
00:00:40,549 --> 00:00:38,719
for the experimental psychiatry at the

18
00:00:42,389 --> 00:00:40,559
perlman school of medicine at the

19
00:00:43,990 --> 00:00:42,399
university of pennsylvania so first off

20
00:00:46,389 --> 00:00:44,000
doctor thank you so much for joining me

21
00:00:48,630 --> 00:00:46,399
today and if you could start us off what

22
00:00:51,670 --> 00:00:48,640
is it about living on the international

23
00:00:53,350 --> 00:00:51,680
space station uh that makes crews

24
00:00:56,549 --> 00:00:53,360
susceptible to things like you know

25
00:00:58,549 --> 00:00:56,559
fatigue or other stress indicators

26
00:01:00,470 --> 00:00:58,559
so thanks for having me first of all we

27
00:01:02,150 --> 00:01:00,480
wanted to document are they fatigued and

28
00:01:03,990 --> 00:01:02,160
the reaction stealth test contains a

29
00:01:06,469 --> 00:01:04,000
series of questions and a very brief

30
00:01:09,670 --> 00:01:06,479
vigilance test uh and we gathered about

31
00:01:11,750 --> 00:01:09,680
2500 responses from astronauts 24

32
00:01:13,109 --> 00:01:11,760
astronauts over six-month missions and

33
00:01:15,590 --> 00:01:13,119
there's no question they're reporting

34
00:01:17,030 --> 00:01:15,600
more fatigue and more physical fatigue

35
00:01:18,390 --> 00:01:17,040
and mental feed

36
00:01:21,030 --> 00:01:18,400
they're also the reporting higher

37
00:01:23,190 --> 00:01:21,040
workload than we see people uh rating in

38
00:01:25,510 --> 00:01:23,200

the analogs on earth so one possible

39
00:01:27,429 --> 00:01:25,520
factor could be increased workload but

40
00:01:29,990 --> 00:01:27,439
they're also showing signs of reduced

41
00:01:31,030 --> 00:01:30,000
sleep time and some of them poor sleep

42
00:01:32,630 --> 00:01:31,040
quality

43
00:01:34,310 --> 00:01:32,640
and as a result we think there's a

44
00:01:36,310 --> 00:01:34,320
combination of factors including

45
00:01:38,950 --> 00:01:36,320
potentially physical factors because

46
00:01:40,469 --> 00:01:38,960
they show increased uh responses of

47
00:01:42,230 --> 00:01:40,479
physical exhaustion

48
00:01:43,990 --> 00:01:42,240
and that's unusual given that they're in

49
00:01:45,510 --> 00:01:44,000
microgravity

50
00:01:47,030 --> 00:01:45,520
so you've gotten a lot of data they're

51
00:01:48,630 --> 00:01:47,040
showing signs of fatigue what are some

52
00:01:50,469 --> 00:01:48,640
of the effects that this increase of

53
00:01:52,630 --> 00:01:50,479
fatigue can have on these crew members

54
00:01:54,310 --> 00:01:52,640
while they're up in space

55
00:01:56,709 --> 00:01:54,320
well this is really the reason for doing

56
00:01:58,630 --> 00:01:56,719
getting this data set to understand uh

57
00:02:00,310 --> 00:01:58,640
what we sometimes refer to as behavioral

58
00:02:02,870 --> 00:02:00,320
health or neural behavioral health sort

59
00:02:05,190 --> 00:02:02,880
of brain and behavior are there changes

60
00:02:06,709 --> 00:02:05,200
uh ongoing in the space environment and

61
00:02:09,270 --> 00:02:06,719
are some of those could some of those be

62
00:02:11,830 --> 00:02:09,280
mitigated by operational interventions

63
00:02:14,869 --> 00:02:11,840

versus health interventions and uh it

64
00:02:17,510 --> 00:02:14,879
looks very much now like um one big

65
00:02:19,350 --> 00:02:17,520
finding is there's a large differential

66
00:02:21,910 --> 00:02:19,360
vulnerability meaning some astronauts

67
00:02:24,869 --> 00:02:21,920
cope much more effectively with these

68
00:02:28,070 --> 00:02:24,879
factors than others others report being

69
00:02:29,990 --> 00:02:28,080
more impacted by them more exhausted uh

70
00:02:31,910 --> 00:02:30,000
struggling more to function

71
00:02:34,070 --> 00:02:31,920
most of them can hold their performance

72
00:02:36,309 --> 00:02:34,080
up very high and this test is annoying

73
00:02:38,309 --> 00:02:36,319
to do and we had to do it at least twice

74
00:02:39,830 --> 00:02:38,319
a day so they were really challenged to

75
00:02:41,670 --> 00:02:39,840
keep doing it only takes five minutes

76
00:02:44,470 --> 00:02:41,680
but it's not terribly interesting you

77
00:02:47,430 --> 00:02:44,480
have to focus your attention it's may be

78
00:02:49,110 --> 00:02:47,440
to be hard to do uh with the demand on

79
00:02:51,030 --> 00:02:49,120
attention and in

80
00:02:53,030 --> 00:02:51,040
doing that we find that some of them can

81
00:02:54,869 --> 00:02:53,040
do that rock solid and stay right with

82
00:02:56,470 --> 00:02:54,879
it and others have much more difficulty

83
00:02:58,710 --> 00:02:56,480
and they also are the ones reporting

84
00:03:01,030 --> 00:02:58,720
more difficulty with exhaustion

85
00:03:03,030 --> 00:03:01,040
okay so walk me through a little bit so

86
00:03:04,309 --> 00:03:03,040
what is the test you said it can be a

87
00:03:05,589 --> 00:03:04,319
little bit difficult for these crew

88
00:03:07,509 --> 00:03:05,599

members how exactly are you guys

89
00:03:09,030 --> 00:03:07,519
gathering this data from all these crews

90
00:03:11,110 --> 00:03:09,040
on board the station

91
00:03:12,630 --> 00:03:11,120
well the test is all all of this and the

92
00:03:14,550 --> 00:03:12,640
q a on the test everything on it is in

93
00:03:16,790 --> 00:03:14,560
software on the support computers on the

94
00:03:18,710 --> 00:03:16,800
station so an astronaut can take open up

95
00:03:20,390 --> 00:03:18,720
any support computer and take the test

96
00:03:21,910 --> 00:03:20,400
the performance test is three minutes

97
00:03:24,070 --> 00:03:21,920
it's called the psychomotor vigilance

98
00:03:26,309 --> 00:03:24,080
test it's actually the brief version and

99
00:03:27,670 --> 00:03:26,319
it's it's actually astonishingly simple

100
00:03:29,350 --> 00:03:27,680
you simply watch the screen to the

101
00:03:31,430 --> 00:03:29,360
computer and when a light comes on you

102
00:03:33,509 --> 00:03:31,440
press the key just face bother your

103
00:03:35,190 --> 00:03:33,519
fingers on and the

104
00:03:37,430 --> 00:03:35,200
is actually a millisecond counter

105
00:03:39,430 --> 00:03:37,440
thousandths of a second going by and it

106
00:03:41,509 --> 00:03:39,440
stops and tells you how fast you were

107
00:03:43,190 --> 00:03:41,519
then it goes out and randomly comes back

108
00:03:44,949 --> 00:03:43,200
on again and you do that for three

109
00:03:47,350 --> 00:03:44,959
minutes it has it's unaffected by

110
00:03:49,589 --> 00:03:47,360
educational background and by learning

111
00:03:51,830 --> 00:03:49,599
it is well validated scientifically on

112
00:03:54,149 --> 00:03:51,840
earth to be extremely sensitive to

113
00:03:56,149 --> 00:03:54,159

fatigue level and so what we're doing is

114
00:03:57,509 --> 00:03:56,159
using this objective probe to get a

115
00:03:59,670 --> 00:03:57,519
sense of how much astronauts are

116
00:04:01,830 --> 00:03:59,680
affected by these subjective fatigue

117
00:04:03,589 --> 00:04:01,840
they're reporting the space flight

118
00:04:06,149 --> 00:04:03,599
so earlier you had mentioned that you

119
00:04:07,589 --> 00:04:06,159
had compared this to actually analogs or

120
00:04:09,670 --> 00:04:07,599
kind of situations down here on the

121
00:04:11,670 --> 00:04:09,680
ground that mimic the same environment

122
00:04:13,429 --> 00:04:11,680
what are some of the other places or

123
00:04:14,949 --> 00:04:13,439
situations that you've been collecting

124
00:04:17,430 --> 00:04:14,959
data from to compare against the

125
00:04:19,189 --> 00:04:17,440
international space station

126
00:04:20,789 --> 00:04:19,199
well we've been particularly fortunate

127
00:04:22,469 --> 00:04:20,799
first of all the test was developed on

128
00:04:25,270 --> 00:04:22,479
astronauts since they're such high

129
00:04:28,230 --> 00:04:25,280
performers we tend to develop our tests

130
00:04:30,950 --> 00:04:28,240
on amnaps on earth so nemo for example

131
00:04:33,350 --> 00:04:30,960
was a location under the ocean uh then

132
00:04:35,350 --> 00:04:33,360
we went on uh to look at astronauts in

133
00:04:37,430 --> 00:04:35,360
the high desert in

134
00:04:39,749 --> 00:04:37,440
a number of other locations but we also

135
00:04:42,150 --> 00:04:39,759
did the russian 520 day simulator

136
00:04:44,310 --> 00:04:42,160
mission and got a thousand responses out

137
00:04:45,749 --> 00:04:44,320
of those crews on this test and so we

138
00:04:47,430 --> 00:04:45,759

have a lot of data to compare we've got

139
00:04:50,150 --> 00:04:47,440
a lot of those comparisons

140
00:04:51,430 --> 00:04:50,160
okay well i mean it's it's a fascinating

141
00:04:53,030 --> 00:04:51,440
study and you're going to be getting

142
00:04:54,629 --> 00:04:53,040
some special data from these one-year

143
00:04:57,670 --> 00:04:54,639
crew members on board the international

144
00:04:59,030 --> 00:04:57,680
space station so again dr david dinges

145
00:05:00,710 --> 00:04:59,040
from the university of pennsylvania

146
00:05:02,790 --> 00:05:00,720
talking to us about the reaction

147
00:05:04,150 --> 00:05:02,800
self-test ongoing doctor thank you so

148
00:05:05,990 --> 00:05:04,160
much for joining me today really

149
00:05:07,749 --> 00:05:06,000
exciting experiment really appreciate