1
00:00:12,740 --> 00:00:09,500
these sack is a deep space atomic clock

2
00:00:14,330 --> 00:00:12,750
it's a space atomic clock it uses

3
00:00:16,760 --> 00:00:14,340
technology to exist on the ground today

4
00:00:18,230 --> 00:00:16,770
in our ground tracking station those

5
00:00:20,450 --> 00:00:18,240
atomic clocks are and I'm

6
00:00:22,880 --> 00:00:20,460
refrigerator-sized which is not suitable

7
00:00:25,160 --> 00:00:22,890
for Space Flight this clock like smaller

8
00:00:27,259 --> 00:00:25,170
keeps the same kind of accuracy and

9
00:00:31,130 --> 00:00:27,269
stability as ground clocks and enable

10
00:00:32,810 --> 00:00:31,140
enables us to do a space tracking in a

11
00:00:36,620 --> 00:00:32,820
very different way than we traditionally

12
00:00:38,990 --> 00:00:36,630
do it essentially it allows us to take

13
00:00:40,549 --> 00:00:39,000

what is now a two-way exercise where

14
00:00:42,080 --> 00:00:40,559
signals go up from there

15
00:00:44,869 --> 00:00:42,090
food spacecraft and come back down

16
00:00:47,690 --> 00:00:44,879
allows us to either track on board the

17
00:00:49,340 --> 00:00:47,700
spacecraft or send from the spacecraft

18
00:00:51,560 --> 00:00:49,350
down at the earth with the one

19
00:00:52,279 --> 00:00:51,570
wavelength and that enables a lot of

20
00:00:54,529 --> 00:00:52,289
things for us

21
00:00:57,200 --> 00:00:54,539
one is that measurement can be much more

22
00:00:59,299 --> 00:00:57,210
accurate than the two a measurement so

23
00:01:02,150 --> 00:00:59,309
that improves our net overall navigation

24
00:01:04,100 --> 00:01:02,160
it also uses uses the tracking networks

25
00:01:07,130 --> 00:01:04,110
much more efficiently so we can get more

26
00:01:10,880 --> 00:01:07,140
data there are other applications for it

27
00:01:13,429 --> 00:01:10,890
it's helps with any endeavor that uses

28
00:01:14,990 --> 00:01:13,439
radio signals for science like gravity

29
00:01:16,969 --> 00:01:15,000
science or atmospheric science and

30
00:01:19,640 --> 00:01:16,979
planets and then here near our Earth's

31
00:01:22,010 --> 00:01:19,650
space clocks are fundamental to the

32
00:01:25,010 --> 00:01:22,020
things like the GPS system without them

33
00:01:27,980 --> 00:01:25,020
we wouldn't have GPS and so our clock

34
00:01:30,530 --> 00:01:27,990
these sack is about an order of

35
00:01:32,780 --> 00:01:30,540
magnitude more accurate and stable than

36
00:01:35,130 --> 00:01:32,790
the existing GPS based clocks

37
00:01:36,690 --> 00:01:35,140
it's been an exciting year

38
00:01:39,660 --> 00:01:36,700

we've made a lot of progress with the

39
00:01:42,330 --> 00:01:39,670
design and detail development of the

40
00:01:45,360 --> 00:01:42,340
clock we went through some critical

41
00:01:47,600 --> 00:01:45,370
design reviews and we're icing ahead

42
00:01:50,610 --> 00:01:47,610
with building what we call a bread board

43
00:01:54,330 --> 00:01:50,620
that has flight components for the most

44
00:01:56,219 --> 00:01:54,340
part kind of built in a flat way it's

45
00:01:57,930 --> 00:01:56,229
not in its flight configuration but that

46
00:02:01,740 --> 00:01:57,940
allows us to really check out the clock

47
00:02:04,350 --> 00:02:01,750
and it's in fashion and make sure that

48
00:02:06,090 --> 00:02:04,360
it works like we expect for and in

49
00:02:09,120 --> 00:02:06,100
conjunction with that we're designing

50
00:02:10,650 --> 00:02:09,130
and developing the components of the

51
00:02:13,020 --> 00:02:10,660
actual demonstration unit that we're

52
00:02:14,940 --> 00:02:13,030
going to put in space how are we going

53
00:02:16,949 --> 00:02:14,950
to check out these functions that are

54
00:02:21,170 --> 00:02:16,959
ultimately usable in deep space whether

55
00:02:27,360 --> 00:02:24,360
gravity science at a at a satellite like

56
00:02:28,770 --> 00:02:27,370
your ropa we're not obviously gonna be

57
00:02:30,660 --> 00:02:28,780
able to do those things but what's

58
00:02:32,580 --> 00:02:30,670
fundamental to those things is this

59
00:02:34,140 --> 00:02:32,590
measurement of either range or a range

60
00:02:37,110 --> 00:02:34,150
right between the spacecraft into the

61
00:02:39,330 --> 00:02:37,120
tracking source and the clock plays a

62
00:02:41,370 --> 00:02:39,340
key role and making sure that those

63
00:02:44,490 --> 00:02:41,380

measurements are precise as they can be

64
00:02:47,970 --> 00:02:44,500
so in low-earth orbit we can confirm

65
00:02:51,210 --> 00:02:47,980
that accuracy and we can also do some

66
00:02:53,520 --> 00:02:51,220
experiments where we do navigation as if

67
00:02:55,680 --> 00:02:53,530
we were in new space one of the

68
00:02:56,940 --> 00:02:55,690
characteristics of deep space nav is you

69
00:02:59,580 --> 00:02:56,950
get tracking for a while and then you

70
00:03:02,190 --> 00:02:59,590
don't for many hours or maybe a day and

71
00:03:03,810 --> 00:03:02,200
so what's important for the clock is

72
00:03:05,910 --> 00:03:03,820
that it doesn't drift away from where it

73
00:03:07,920 --> 00:03:05,920
needs to be in those tracking gaps and

74
00:03:09,840 --> 00:03:07,930
we can obviously confirm that and low

75
00:03:12,800 --> 00:03:09,850
Earth orbit as well and it's still a

76
00:03:16,229 --> 00:03:12,810
great environment to really check out

77
00:03:17,940 --> 00:03:16,239
robust space operations you know there

78
00:03:20,170 --> 00:03:17,950
are there are effects out there

79
00:03:22,250 --> 00:03:20,180
magnetics and

80
00:03:24,229 --> 00:03:22,260
temperature effects and radiation

81
00:03:26,720 --> 00:03:24,239
effects you know this space and it does

82
00:03:29,990 --> 00:03:26,730
impact the forms clock if we don't model

83
00:03:33,440 --> 00:03:30,000
the count for three hallmark of D sac is

84
00:03:36,619 --> 00:03:33,450
that it doesn't weigh for a typical

85
00:03:39,440 --> 00:03:36,629
10-year deep space mission de sac would

86
00:03:42,410 --> 00:03:39,450
either would lose or gain only about a