MISSION IMAGINATION

Orbital Debris

1
00:00:13,430 --> 00:00:11,240
hi I am dr. JC Lou the NASA chief

2
00:00:16,460 --> 00:00:13,440
scientist for orbital debris at the

3
00:00:17,779 --> 00:00:16,470
Johnson Space Center hi I'm Bryan Corley

4
00:00:19,040 --> 00:00:17,789
the lead of the ISS trajectory

5
00:00:21,200 --> 00:00:19,050
operations and planning group at the

6
00:00:24,439 --> 00:00:21,210
Johnson Space Center welcome to Mission

7
00:00:28,009 --> 00:00:24,449
imagination how did you get into this

8
00:00:31,700 --> 00:00:28,019
line of work I came to Johnson Space

9
00:00:34,280 --> 00:00:31,710
Center as a postdoc research fellow more

10
00:00:36,709 --> 00:00:34,290
than 20 years ago from a very young age

11
00:00:37,970 --> 00:00:36,719
I used to love math and science I also

12
00:00:39,680 --> 00:00:37,980
enjoyed building things and more

13
00:00:42,130 --> 00:00:39,690

importantly taking apart to understand

14
00:00:45,110 --> 00:00:42,140
how they work my initial research

15
00:00:48,200 --> 00:00:45,120
focused on the dynamics of asteroids

16
00:00:50,720 --> 00:00:48,210
comments and meteoroids in the solar

17
00:00:52,369 --> 00:00:50,730
system ultimately achieved an aerospace

18
00:00:53,450 --> 00:00:52,379
engineering degree and figured what

19
00:00:55,549 --> 00:00:53,460
better place to put that into practice

20
00:00:58,670 --> 00:00:55,559
and here at Johnson Space Center or

21
00:01:02,029 --> 00:00:58,680
recent people into outer space what is

22
00:01:05,450 --> 00:01:02,039
orbital debris the term orbital debris

23
00:01:08,149 --> 00:01:05,460
is used to describe any human-made

24
00:01:11,660 --> 00:01:08,159
object in Earth orbit that does not

25
00:01:14,810 --> 00:01:11,670
serve any useful purpose typical example

26
00:01:17,899 --> 00:01:14,820
of orbital debris include spin rocky

27
00:01:20,899 --> 00:01:17,909
bodies retired spacecraft and wake up

28
00:01:24,550 --> 00:01:20,909
remnants generated from exposures or

29
00:01:27,490 --> 00:01:24,560
collisions of rocky bodies or spacecraft

30
00:01:31,370 --> 00:01:27,500
why do we care about orbital debris

31
00:01:34,160 --> 00:01:31,380
there are two reasons first the

32
00:01:36,649 --> 00:01:34,170
increasing number of orbital debris in

33
00:01:40,030 --> 00:01:36,659
the near-earth space environment and

34
00:01:43,819 --> 00:01:40,040
second the high impact speed in space

35
00:01:47,030 --> 00:01:43,829
this aluminum block is about half an

36
00:01:51,139 --> 00:01:47,040
inch thick in this penetration damage

37
00:01:54,920 --> 00:01:51,149
was caused by this tiny object here this

38
00:01:57,620 --> 00:01:54,930

diameter is only 18 of each

39
00:02:01,730 --> 00:01:57,630
the impact speed not caused this damage

40
00:02:04,400 --> 00:02:01,740
was seven kilometers per second which is

41
00:02:07,370 --> 00:02:04,410
actually lower than the average orbital

42
00:02:10,969 --> 00:02:07,380
debris impact speed at the International

43
00:02:13,340 --> 00:02:10,979
Space Station altitude how is the crew

44
00:02:14,750 --> 00:02:13,350
protected from overall debris the space

45
00:02:16,310 --> 00:02:14,760
station has shielding to protect it from

46
00:02:18,740 --> 00:02:16,320
small particles about the size of the

47
00:02:20,090 --> 00:02:18,750
New Year fingertip or one centimeter for

48
00:02:21,920 --> 00:02:20,100
larger particles about the size of your

49
00:02:23,300 --> 00:02:21,930
fist ten centimeters we can track those

50
00:02:24,620 --> 00:02:23,310
from the ground if they pose a risk to

51
00:02:26,420 --> 00:02:24,630
the space station we actually move it

52
00:02:28,370 --> 00:02:26,430
out of the way if the space station were

53
00:02:30,140 --> 00:02:28,380
to be penetrated by orbital debris the

54
00:02:32,479 --> 00:02:30,150
crew is trained it has procedures to

55
00:02:35,870 --> 00:02:32,489
detect a leak and patch it to save the

56
00:02:38,180 --> 00:02:35,880
ISS how do I avoidance maneuvers work on

57
00:02:39,770 --> 00:02:38,190
the International Space Station the

58
00:02:42,380 --> 00:02:39,780
first step in protection is tracking the

59
00:02:44,540 --> 00:02:42,390
debris the Air Force uses radars to

60
00:02:45,949 --> 00:02:44,550
track the 23,000 objects in space that

61
00:02:47,600 --> 00:02:45,959
are larger than your fist and they

62
00:02:49,850 --> 00:02:47,610
notify us if something comes within a

63
00:02:51,260 --> 00:02:49,860

certain volume of the ISS this is a

64
00:02:52,820 --> 00:02:51,270
highly choreographed process which

65
00:02:55,460 --> 00:02:52,830
involves Mission Control in both Houston

66
00:02:58,010 --> 00:02:55,470
and Moscow since the engines to perform

67
00:02:59,539 --> 00:02:58,020
the maneuver are Russian control on our

68
00:03:01,370 --> 00:02:59,549
typical circumstances we have a couple

69
00:03:03,259 --> 00:03:01,380
days to evaluate the risk and plan the

70
00:03:05,630 --> 00:03:03,269
maneuvers but it can be performed in as

71
00:03:07,460 --> 00:03:05,640
little as three hours if the risk is

72
00:03:09,680 --> 00:03:07,470
higher than one in 10,000 in a maneuver

73
00:03:11,449 --> 00:03:09,690
cannot be performed the crew will enter

74
00:03:13,400 --> 00:03:11,459
the respective return vehicles ready to

75
00:03:17,600 --> 00:03:13,410
perform an emergency undock should a

76
00:03:20,210 --> 00:03:17,610
collision occur how do we manage the

77
00:03:24,080 --> 00:03:20,220
orbital debris problem to better protect

78
00:03:26,060 --> 00:03:24,090
future space missions the most important

79
00:03:28,940 --> 00:03:26,070
step to manage the orbital debris

80
00:03:32,750 --> 00:03:28,950
problem is to limit the generation of

81
00:03:36,229 --> 00:03:32,760
new degree in the future there are

82
00:03:40,100 --> 00:03:36,239
existing policies and guidelines at NASA

83
00:03:43,400 --> 00:03:40,110
and at the international level to limit

84
00:03:46,699 --> 00:03:43,410
the generation of new debris orbital

85
00:03:49,340 --> 00:03:46,709
debris is a very difficult problem it

86
00:03:52,039 --> 00:03:49,350
will require a good international effort

87
00:03:57,040 --> 00:03:52,049
to mitigate the orbital debris problem

88
00:04:00,800 --> 00:03:59,390

now it's time for you to put science

89
00:04:02,840 --> 00:04:00,810
technology engineering and mathematics

90
00:04:06,370 --> 00:04:02,850
to work something we do at NASA every

91
00:04:10,430 --> 00:04:06,380
day good luck unchallenged number four