



1
00:00:03,439 --> 00:00:28,230
disabled

2
00:00:41,990 --> 00:00:38,229
is

3
00:00:43,590 --> 00:00:42,000
thursday evening i thought oh that's

4
00:00:44,389 --> 00:00:43,600
that's odd

5
00:00:46,310 --> 00:00:44,399
um

6
00:00:48,549 --> 00:00:46,320
but let's not panic just yet and then we

7
00:00:50,229 --> 00:00:48,559
got an update on friday

8
00:00:52,709 --> 00:00:50,239
and it looks worse

9
00:00:53,510 --> 00:00:52,719
oh my heart sank

10
00:01:00,150 --> 00:00:53,520
um

11
00:01:02,150 --> 00:01:00,160
and it just you know didn't get better

12
00:01:03,110 --> 00:01:02,160
there are all kinds of things orbiting

13
00:01:04,630 --> 00:01:03,120

the earth

14

00:01:06,789 --> 00:01:04,640

obviously the active spacecraft that

15

00:01:09,190 --> 00:01:06,799

we're still using but also

16

00:01:11,350 --> 00:01:09,200

expired spacecraft many of them still on

17

00:01:15,190 --> 00:01:11,360

orbit and then there are

18

00:01:17,270 --> 00:01:15,200

old parts and then real debris down to

19

00:01:18,390 --> 00:01:17,280

flecks of paint

20

00:01:21,270 --> 00:01:18,400

if you see

21

00:01:24,390 --> 00:01:21,280

a piece of debris far enough in advance

22

00:01:26,870 --> 00:01:24,400

you can decide to alter your orbit to

23

00:01:28,230 --> 00:01:26,880

make sure that your orbit and its orbit

24

00:01:30,149 --> 00:01:28,240

don't intersect that there isn't a

25

00:01:32,390 --> 00:01:30,159

collision

26

00:01:34,310 --> 00:01:32,400

fermi is a special kind of telescope

27

00:01:36,310 --> 00:01:34,320

designed to make observations of the

28

00:01:38,469 --> 00:01:36,320

universe in the highest energy form of

29

00:01:40,870 --> 00:01:38,479

light in gamma rays

30

00:01:43,190 --> 00:01:40,880

fermi sees gamma rays from supermassive

31

00:01:45,270 --> 00:01:43,200

black holes gamma rays from the remnants

32

00:01:47,590 --> 00:01:45,280

of stars that exploded at the end of

33

00:01:49,510 --> 00:01:47,600

their life but we also see gamma rays

34

00:01:51,749 --> 00:01:49,520

from flares from the sun

35

00:01:53,270 --> 00:01:51,759

we get a very different picture and thus

36

00:01:54,870 --> 00:01:53,280

a much deeper understanding of what

37

00:01:57,030 --> 00:01:54,880

you're looking at

38

00:01:58,389 --> 00:01:57,040

late march of 2012

39

00:01:59,510 --> 00:01:58,399

we got a call from the department of

40

00:02:02,389 --> 00:01:59,520

defense

41

00:02:04,310 --> 00:02:02,399

there was a defunct russian satellite in

42

00:02:06,789 --> 00:02:04,320

an orbit that would intersect fermi's

43

00:02:08,550 --> 00:02:06,799

orbit in about a week it isn't that they

44

00:02:09,830 --> 00:02:08,560

knew they were going to hit it was that

45

00:02:11,589 --> 00:02:09,840

they didn't know that they weren't going

46

00:02:13,110 --> 00:02:11,599

to hit so that's something we had to be

47

00:02:15,030 --> 00:02:13,120

concerned about

48

00:02:17,430 --> 00:02:15,040

those two spacecraft were occupying the

49

00:02:20,309 --> 00:02:17,440

same space within 30 milliseconds of

50

00:02:23,430 --> 00:02:20,319

each other that's why this was scary

51
00:02:26,070 --> 00:02:23,440
these are objects several tons each as

52
00:02:28,309 --> 00:02:26,080
wide as a small airplane traveling 20

53
00:02:30,150 --> 00:02:28,319
times faster than a bullet the fermi

54
00:02:33,589 --> 00:02:30,160
mission would be over the spacecraft

55
00:02:35,350 --> 00:02:33,599
almost certainly would not survive that

56
00:02:38,710 --> 00:02:35,360
the basics of the collision avoidance

57
00:02:41,030 --> 00:02:38,720
maneuver is we just use our thrusters to

58
00:02:42,790 --> 00:02:41,040
alter orbit slight amount just to

59
00:02:44,869 --> 00:02:42,800
provide a little bit of separation

60
00:02:47,670 --> 00:02:44,879
between ourselves and the other piece of

61
00:02:51,589 --> 00:02:49,509
we hadn't ever used the propulsion

62
00:02:54,070 --> 00:02:51,599
system before

63
00:02:57,030 --> 00:02:54,080

and using something for the first time

64

00:02:59,750 --> 00:02:57,040

was going to be a major decision

65

00:03:02,390 --> 00:02:59,760

we had to decide

66

00:03:05,030 --> 00:03:02,400

of the two disasters that could happen

67

00:03:07,509 --> 00:03:05,040

the collision with another satellite

68

00:03:09,910 --> 00:03:07,519

or a fatal failure with a propulsion

69

00:03:11,910 --> 00:03:09,920

system what decision is most defensible

70

00:03:14,229 --> 00:03:11,920

and we concluded that we really needed

71

00:03:17,190 --> 00:03:14,239

to proceed with the burn

72

00:03:20,309 --> 00:03:17,200

latch valves open brine pressure rising

73

00:03:22,550 --> 00:03:20,319

normally the the spacecraft is

74

00:03:23,430 --> 00:03:22,560

orbiting the earth looking at the sky

75

00:03:26,229 --> 00:03:23,440

so

76
00:03:27,910 --> 00:03:26,239
in preparation for the maneuver it

77
00:03:30,070 --> 00:03:27,920
changes its attitude

78
00:03:32,309 --> 00:03:30,080
parks its solar arrays

79
00:03:33,830 --> 00:03:32,319
and its high gain antenna to be out of

80
00:03:35,350 --> 00:03:33,840
the way of the thrusters the the

81
00:03:37,750 --> 00:03:35,360
maneuver itself is just fire all

82
00:03:39,509 --> 00:03:37,760
thrusters for one second

83
00:03:41,910 --> 00:03:39,519
and then after that's done then the

84
00:03:43,750 --> 00:03:41,920
spacecraft goes back to normal science

85
00:03:44,710 --> 00:03:43,760
one second maneuver

86
00:03:46,630 --> 00:03:44,720
copy

87
00:03:50,149 --> 00:03:46,640
maneuver complete

88
00:03:52,630 --> 00:03:50,159

it was a huge relief a huge

89

00:03:55,110 --> 00:03:52,640

weight off my chest

90

00:03:57,670 --> 00:03:55,120

having done the maneuver and avoided a

91

00:03:59,990 --> 00:03:57,680

collision means we continue operating so

92

00:04:01,750 --> 00:04:00,000

continue doing the great science that we