
PROTECTING ASTRONAUTS
FROM SPACE RADIATION

1
00:00:07,130 --> 00:00:04,579
it's August 1972 and in Richardson a

2
00:00:10,070 --> 00:00:07,140
future NASA scientist is watching TV

3
00:00:13,129 --> 00:00:10,080
when the BBC announces the interference

4
00:00:14,690 --> 00:00:13,139
is caused by solar activity he didn't

5
00:00:16,490 --> 00:00:14,700
know it then but the Sun had just

6
00:00:19,429 --> 00:00:16,500
erupted in one of the most powerful

7
00:00:20,990 --> 00:00:19,439
solar events ever recorded there's no

8
00:00:23,029 --> 00:00:21,000
threat to humans because Earth's

9
00:00:25,550 --> 00:00:23,039
magnetic field deflects much of the

10
00:00:27,500 --> 00:00:25,560
sun's radiation but the explosions were

11
00:00:30,230 --> 00:00:27,510
so powerful that intense radiation

12
00:00:33,440 --> 00:00:30,240
disrupted TV signals and caused radio

13
00:00:36,020 --> 00:00:33,450

blackouts so what if you were outside

14
00:00:38,450 --> 00:00:36,030
Earth's magnetic field on the moon and

15
00:00:40,369 --> 00:00:38,460
beyond astronauts face the risk of

16
00:00:43,340 --> 00:00:40,379
extreme radiation exposure

17
00:00:45,709 --> 00:00:43,350
luckily the intense radiation in 1972

18
00:00:48,139 --> 00:00:45,719
occurred right between the Apollo 16 and

19
00:00:50,840 --> 00:00:48,149
17 missions when no astronauts were in

20
00:00:52,790 --> 00:00:50,850
their path as NASA plans missions to go

21
00:00:55,250 --> 00:00:52,800
back to the moon and then on to Mars

22
00:00:57,410 --> 00:00:55,260
predicting the sun's activity to protect

23
00:01:00,020 --> 00:00:57,420
astronauts from space radiation is one

24
00:01:01,819 --> 00:01:00,030
of our biggest priorities when the

25
00:01:03,680 --> 00:01:01,829
biggest unknown factors about going to

26
00:01:06,530 --> 00:01:03,690
space is the radiation hazard from the

27
00:01:08,570 --> 00:01:06,540
Sun this is in today studying the

28
00:01:11,179 --> 00:01:08,580
effects of the Sun also known as the

29
00:01:13,100 --> 00:01:11,189
field of Helio physics the Sun is always

30
00:01:15,710 --> 00:01:13,110
emitting radiation like the light we see

31
00:01:18,530 --> 00:01:15,720
but certain energetic particles like

32
00:01:20,690 --> 00:01:18,540
from the August 1972 events can be far

33
00:01:23,090 --> 00:01:20,700
more harmful to be able to forecast

34
00:01:25,700 --> 00:01:23,100
cellular energetic particles we need to

35
00:01:27,080 --> 00:01:25,710
know how the Sun energizes them the Sun

36
00:01:29,780 --> 00:01:27,090
is made up of electrically charged

37
00:01:32,179 --> 00:01:29,790
particles called plasma as this plasma

38
00:01:35,149 --> 00:01:32,189

moves it builds up energy inside its

39
00:01:36,890 --> 00:01:35,159
massive magnetic field this energy is

40
00:01:39,920 --> 00:01:36,900
usually released in two types of

41
00:01:42,319 --> 00:01:39,930
explosions flares are intense flashes of

42
00:01:44,990 --> 00:01:42,329
Lights coronal mass ejections are giant

43
00:01:46,940 --> 00:01:45,000
eruptions of solar material these solar

44
00:01:48,980 --> 00:01:46,950
eruptions sends shockwaves across the

45
00:01:51,469 --> 00:01:48,990
solar system accelerating particles as

46
00:01:54,830 --> 00:01:51,479
they go these are solar energetic

47
00:01:57,260 --> 00:01:54,840
particles or s EPS it consists mainly of

48
00:01:59,280 --> 00:01:57,270
protons and possess a lot of energy that

49
00:02:02,310 --> 00:01:59,290
can affect satellite measurements

50
00:02:03,990 --> 00:02:02,320
and humans SCPs can bombard you with a

51
00:02:06,300 --> 00:02:04,000
lot of radiation in the short period of

52
00:02:08,910 --> 00:02:06,310
time they can penetrate your skin damage

53
00:02:11,850 --> 00:02:08,920
your DNA and increase your chances of

54
00:02:13,380 --> 00:02:11,860
getting cancer and radiation signals but

55
00:02:16,260 --> 00:02:13,390
they don't occur with every solar

56
00:02:18,780 --> 00:02:16,270
eruption only a small number of flares

57
00:02:21,240 --> 00:02:18,790
and coronal mass ejections create SCPs

58
00:02:23,030 --> 00:02:21,250
so we're trying to predict when SCPs

59
00:02:25,350 --> 00:02:23,040
form and how they travel through space

60
00:02:27,990 --> 00:02:25,360
at NASA's Goddard Space Flight Center

61
00:02:31,470 --> 00:02:28,000
the community coordinated modeling

62
00:02:34,170 --> 00:02:31,480
Center or C CMC is dedicated to testing

63
00:02:35,910 --> 00:02:34,180

prediction models working with global

64
00:02:37,830 --> 00:02:35,920
partners they use data from NASA

65
00:02:40,020 --> 00:02:37,840
satellites at different vantage points

66
00:02:42,240 --> 00:02:40,030
and models to figure out how solar

67
00:02:45,900 --> 00:02:42,250
explosions behave including how

68
00:02:47,940 --> 00:02:45,910
shockwaves energize s EPS and as we get

69
00:02:51,180 --> 00:02:47,950
better at predicting we get more time to

70
00:02:53,160 --> 00:02:51,190
prepare preparation for an SCP event of

71
00:02:55,280 --> 00:02:53,170
which you may know that is already

72
00:02:57,780 --> 00:02:55,290
coming in perhaps a magnitude as well

73
00:03:00,870 --> 00:02:57,790
the technique that you would want to use

74
00:03:03,630 --> 00:03:00,880
is to put as much mass between you and

75
00:03:06,030 --> 00:03:03,640
the source on the surface of the Moon or

76
00:03:08,880 --> 00:03:06,040
Mars astronauts can go underground for

77
00:03:11,100 --> 00:03:08,890
build shelter with local materials but

78
00:03:12,770 --> 00:03:11,110
in transits astronauts can only be

79
00:03:15,300 --> 00:03:12,780
protected with what's on the spacecraft

80
00:03:17,610 --> 00:03:15,310
which means that you might have elements

81
00:03:20,220 --> 00:03:17,620
on a spacecraft that have multiple

82
00:03:22,140 --> 00:03:20,230
purposes NASA's space radiation

83
00:03:24,540 --> 00:03:22,150
specialists are testing different ways

84
00:03:26,940 --> 00:03:24,550
to do this one strategy they tested on

85
00:03:28,800 --> 00:03:26,950
the Orion spacecraft involves crew

86
00:03:30,720 --> 00:03:28,810
members barricading themselves with as

87
00:03:33,540 --> 00:03:30,730
much mass as possible in the center of

88
00:03:36,210 --> 00:03:33,550

the spacecraft other possible techniques

89
00:03:38,310 --> 00:03:36,220
in development include VESA add mass and

90
00:03:41,670 --> 00:03:38,320
electrically charged surfaces that

91
00:03:44,750 --> 00:03:41,680
deflect particles in terms of radiation

92
00:03:46,979 --> 00:03:44,760
protection and radiation mitigation the

93
00:03:50,160 --> 00:03:46,989
factor of time is extraordinarily

94
00:03:52,290 --> 00:03:50,170
important the Sun has a natural 11-year

95
00:03:54,960 --> 00:03:52,300
cycle that transitions through low and

96
00:03:57,780 --> 00:03:54,970
high activity which is indicated by the

97
00:04:00,420 --> 00:03:57,790
number of sunspots on the surface more

98
00:04:02,589 --> 00:04:00,430
sunspots mean more up shion's resulting

99
00:04:05,309 --> 00:04:02,599
in a higher risk for scps

100
00:04:08,289 --> 00:04:05,319
but during this increased solar activity

101
00:04:10,509 --> 00:04:08,299
the sun's magnetic field strengthens

102
00:04:12,910 --> 00:04:10,519
enhancing its shield against another

103
00:04:16,150 --> 00:04:12,920
important source of radiation galactic

104
00:04:17,680 --> 00:04:16,160
cosmic rains these are charged particles

105
00:04:19,990 --> 00:04:17,690
traveling at nearly the speed of light

106
00:04:21,879 --> 00:04:20,000
that are thought to come from supernova

107
00:04:24,999 --> 00:04:21,889
explosions from within our galaxy and

108
00:04:27,400 --> 00:04:25,009
possibly further out in the universe if

109
00:04:29,650 --> 00:04:27,410
solar energetic particles are intense

110
00:04:32,710 --> 00:04:29,660
sporadic storms then galactic cosmic

111
00:04:34,900 --> 00:04:32,720
rays are a constant drizzle galactic

112
00:04:37,330 --> 00:04:34,910
cosmic rays are more sparse but also

113
00:04:39,100 --> 00:04:37,340

much more energetic they include heavier

114
00:04:42,310 --> 00:04:39,110
elements that can penetrate through vast

115
00:04:44,620 --> 00:04:42,320
amounts of materials understanding the

116
00:04:46,839 --> 00:04:44,630
rate of galactic cosmic rays helps us

117
00:04:50,140 --> 00:04:46,849
determine how much time astronauts can

118
00:04:52,240 --> 00:04:50,150
spend in space safely the date humans

119
00:04:54,460 --> 00:04:52,250
have only been on the lunar surface for

120
00:04:56,980 --> 00:04:54,470
a cumulative total of about 12 days a

121
00:04:59,439 --> 00:04:56,990
trip to Mars will take six or ten months

122
00:05:01,839 --> 00:04:59,449
each way that means even more radiation

123
00:05:04,300 --> 00:05:01,849
exposure and so NASA is doing work to

124
00:05:06,189 --> 00:05:04,310
prepare for that the moon is going to be

125
00:05:08,860 --> 00:05:06,199
a test bed for us in order to be able to

126
00:05:11,890 --> 00:05:08,870
prepare for Mars the more that we

127
00:05:14,350 --> 00:05:11,900
understand the impact in the duration of

128
00:05:16,990 --> 00:05:14,360
radiation on the moon the more we can

129
00:05:19,060 --> 00:05:17,000
extrapolate that to the length of time

130
00:05:24,370 --> 00:05:19,070
that we will be spending in transit and