1
00:00:13,779 --> 00:00:11,740
Aref based communications are currently

2
00:00:16,450 --> 00:00:13,789
the cornerstone of space communications

3
00:00:18,580 --> 00:00:16,460
but the radio and microwave portions of

4
00:00:21,550 --> 00:00:18,590
the electromagnetic spectrum are getting

5
00:00:23,589 --> 00:00:21,560
close to capacity so with the reliable

6
00:00:25,749 --> 00:00:23,599
infrared laser similar to the fiber

7
00:00:27,220 --> 00:00:25,759
optic cable bringing TV internet and

8
00:00:29,950 --> 00:00:27,230
phone into your home

9
00:00:33,720 --> 00:00:29,960
NASA is venturing into a new age of

10
00:00:36,790 --> 00:00:33,730
high-speed data delivery why lasers

11
00:00:38,770 --> 00:00:36,800
radiofrequency and lasers both travel at

12
00:00:42,520 --> 00:00:38,780
the speed of light and in the form of a

13
00:00:45,549 --> 00:00:42,530

wave but 10,000 infrared waves can fit

14
00:00:48,130 --> 00:00:45,559
into one radio wave which means you can

15
00:00:50,590 --> 00:00:48,140
get more information faster via laser

16
00:00:53,650 --> 00:00:50,600
light over the same period of time than

17
00:00:56,080 --> 00:00:53,660
you would with RF the concept of

18
00:00:58,599 --> 00:00:56,090
space-based optical communications has

19
00:01:01,270 --> 00:00:58,609
been proven in previous low data rate

20
00:01:03,400 --> 00:01:01,280
demonstrations but the lunar laser

21
00:01:06,040 --> 00:01:03,410
communications demonstration will

22
00:01:08,350 --> 00:01:06,050
introduce a new infrastructure and we'll

23
00:01:10,620 --> 00:01:08,360
have the ability to transfer data five

24
00:01:14,230 --> 00:01:10,630
times faster than its predecessors

25
00:01:16,660 --> 00:01:14,240
although short-lived LLC D will provide

26
00:01:20,649 --> 00:01:16,670
an important building block to the next

27
00:01:22,719 --> 00:01:20,659
tier of laser communications so with one

28
00:01:25,510 --> 00:01:22,729
eye on the present and the other on the

29
00:01:27,760 --> 00:01:25,520
future NASA is preparing to implement an

30
00:01:30,670 --> 00:01:27,770
operational optical communications

31
00:01:33,190 --> 00:01:30,680
network the laser communications relay

32
00:01:35,950 --> 00:01:33,200
demonstration is the first step in

33
00:01:38,679 --> 00:01:35,960
establishing this infrastructure over a

34
00:01:41,380 --> 00:01:38,689
two-year period laser comm will leverage

35
00:01:43,420 --> 00:01:41,390
the pioneering work of LLC D and other

36
00:01:46,209 --> 00:01:43,430
optical communications technology

37
00:01:48,219 --> 00:01:46,219
efforts to move another step closer to

38
00:01:51,219 --> 00:01:48,229

the ultimate vision of a satellite to

39
00:01:52,990 --> 00:01:51,229
ground optical network essentially this

40
00:01:55,810 --> 00:01:53,000
network would be capable of supporting

41
00:02:01,029 --> 00:01:55,820
both deep space missions and near earth

42
00:02:02,730 --> 00:02:01,039
communication needs LC Rd will expand on

43
00:02:05,130 --> 00:02:02,740
the capabilities of the lunar laser

44
00:02:07,539 --> 00:02:05,140
communications demo by leveraging

45
00:02:09,999 --> 00:02:07,549
commercialized optical communication

46
00:02:12,010 --> 00:02:10,009
components and existing operational

47
00:02:15,560 --> 00:02:12,020
ground facilities

48
00:02:17,570 --> 00:02:15,570
our partners at MIT Lincoln lab are

49
00:02:19,520 --> 00:02:17,580
nearing completion of the designs and

50
00:02:23,120 --> 00:02:19,530
flight qualifications of the optical

51
00:02:26,420 --> 00:02:23,130
module the ppm and dpsk modem and the

52
00:02:28,700 --> 00:02:26,430
optical module controller they have

53
00:02:30,830 --> 00:02:28,710
recently installed the lunar laser comm

54
00:02:34,460 --> 00:02:30,840
ground terminal at the white sands

55
00:02:38,540 --> 00:02:34,470
complex in New Mexico to support the LLC

56
00:02:41,630 --> 00:02:38,550
D operations the ll GT will become one

57
00:02:43,850 --> 00:02:41,640
of LCR DS ground terminals after some

58
00:02:47,000 --> 00:02:43,860
minor modifications such as installing

59
00:02:50,180 --> 00:02:47,010
adaptive optics data recorders modems

60
00:02:52,280 --> 00:02:50,190
and other ground support equipment once

61
00:02:54,680 --> 00:02:52,290
retrofitted the ground terminal will

62
00:02:57,380 --> 00:02:54,690
transmit a beacon and communication data

63
00:03:00,740 --> 00:02:57,390

through only one transmitting telescope

64
00:03:03,230 --> 00:03:00,750
and receive both the dpsk and ppm

65
00:03:05,690 --> 00:03:03,240
modulated optical signals from the

66
00:03:10,370 --> 00:03:05,700
spacecraft through only one receiving

67
00:03:12,220 --> 00:03:10,380
telescope the LCR D team at the Jet

68
00:03:15,080 --> 00:03:12,230
Propulsion lab in Pasadena California

69
00:03:17,300 --> 00:03:15,090
will make similar modifications to the

70
00:03:19,430 --> 00:03:17,310
octal telescope facility on Table

71
00:03:23,000 --> 00:03:19,440
Mountain which will serve as the second

72
00:03:26,300 --> 00:03:23,010
LC Rd ground station together these

73
00:03:28,550 --> 00:03:26,310
ground stations will allow LC Rd to

74
00:03:31,130 --> 00:03:28,560
demonstrate its real-time optical

75
00:03:33,320 --> 00:03:31,140
communications relay capability as well

76
00:03:36,050 --> 00:03:33,330
as characterizing performance and

77
00:03:39,290 --> 00:03:36,060
atmospheric effects such effects on the

78
00:03:43,700 --> 00:03:39,300
dpsk signal is why adaptive optics is

79
00:03:45,620 --> 00:03:43,710
needed on both facilities in keeping

80
00:03:48,350 --> 00:03:45,630
with NASA's goal of a cost-effective

81
00:03:50,360 --> 00:03:48,360
technology demonstration NASA Goddard is

82
00:03:52,700 --> 00:03:50,370
procuring the commercialized hardware

83
00:03:55,300 --> 00:03:52,710
like the optical module the controller

84
00:03:57,950 --> 00:03:55,310
electronics and the space switching unit

85
00:04:00,530 --> 00:03:57,960
Goddard is also building the modems

86
00:04:03,050 --> 00:04:00,540
in-house according to the MIT Lincoln

87
00:04:06,200 --> 00:04:03,060
lab designs which call for the ppm and

88
00:04:07,090 --> 00:04:06,210

dpsk modulations to be built into one

89
00:04:10,070 --> 00:04:07,100
modem

90
00:04:13,340 --> 00:04:10,080
in order to utilize existing commercial

91
00:04:15,590 --> 00:04:13,350
access to space Space Systems Loral will

92
00:04:17,600 --> 00:04:15,600
host the laser comm payload on one of

93
00:04:19,850 --> 00:04:17,610
its commercial satellites which is a

94
00:04:26,480 --> 00:04:19,860
first for NASA this highly anticipated

95
00:04:28,970 --> 00:04:26,490
launch is scheduled for 2017 higher

96
00:04:31,040 --> 00:04:28,980
volume and lower error rates will enable

97
00:04:33,770 --> 00:04:31,050
the next generation of tracking and data

98
00:04:36,310 --> 00:04:33,780
relay satellites to evolve into a global

99
00:04:38,510 --> 00:04:36,320
network which offers optical services

100
00:04:40,940 --> 00:04:38,520
future near Earth and deep space

101
00:04:43,100 --> 00:04:40,950
missions will transmit unprecedented

102
00:04:45,680 --> 00:04:43,110
amounts of data as will commercial and

103
00:04:47,660 --> 00:04:45,690
military spacecraft we already know that

104
00:04:50,480 --> 00:04:47,670
data handling and transmission needs

105
00:04:52,580 --> 00:04:50,490
evolved rapidly and NASA intends to meet

106
00:04:54,740 --> 00:04:52,590
those needs before there were

107
00:04:56,600 --> 00:04:54,750
smartphones the idea of streaming HD

108
00:04:59,480 --> 00:04:56,610
video to your cellphone was thought to

109
00:05:01,700 --> 00:04:59,490
be futuristic and far off the same could

110
00:05:04,190 --> 00:05:01,710
be said about NASA streaming HD content

111
00:05:07,190 --> 00:05:04,200
from the surface of Mars but this could

112
00:05:09,440 --> 00:05:07,200
happen in just a few short years our

113
00:05:11,540 --> 00:05:09,450

communications infrastructure needs to

114
00:05:14,600 --> 00:05:11,550
be ready to support tomorrow's demands

115
00:05:17,090 --> 00:05:14,610
and Elsi Rd is the first giant leap in

116
00:05:19,880 --> 00:05:17,100
establishing our operational optical