GO NOW!
LANDSAT & THE *CALYPSO* CAPER

1
00:00:02,070 --> 00:00:07,349
[Music]

2
00:00:12,390 --> 00:00:09,750
our oceans connect us

3
00:00:15,190 --> 00:00:12,400
a vast network of waterways supporting

4
00:00:18,150 --> 00:00:15,200
the global transit of almost 80 percent

5
00:00:21,429 --> 00:00:18,160
of all goods that's nearly 11 billion

6
00:00:24,390 --> 00:00:21,439
tons of food medicine and many items we

7
00:00:26,870 --> 00:00:24,400
rely on in our daily lives

8
00:00:29,269 --> 00:00:26,880
with coastlines constantly changing how

9
00:00:31,750 --> 00:00:29,279
do large ships safely navigate these

10
00:00:34,069 --> 00:00:31,760
waterways with shallow water features

11
00:00:36,549 --> 00:00:34,079
such as reefs and shoals it is essential

12
00:00:39,510 --> 00:00:36,559
to have accurate maps so ships can avoid

13
00:00:43,030 --> 00:00:39,520

these serious navigation hazards

14
00:00:45,110 --> 00:00:43,040
in the summer of 1975 jacques cousteau

15
00:00:47,590 --> 00:00:45,120
and nasa teamed up with landsat

16
00:00:49,830 --> 00:00:47,600
satellites to see if the same technology

17
00:00:52,229 --> 00:00:49,840
that discovered new coral reefs

18
00:00:54,950 --> 00:00:52,239
corrected coastline maps and revealed

19
00:00:58,310 --> 00:00:54,960
uncharted islands could also measure

20
00:01:01,189 --> 00:00:58,320
shallow water depth from space by the

21
00:01:06,469 --> 00:01:01,199
radio we get the information

22
00:01:10,789 --> 00:01:08,230
measurements of water depth or

23
00:01:12,390 --> 00:01:10,799
bathymetry allow scientists to chart the

24
00:01:14,550 --> 00:01:12,400
marine landscape

25
00:01:17,190 --> 00:01:14,560
and just as aerial photography

26
00:01:19,510 --> 00:01:17,200
revolutionized topographic mapping

27
00:01:21,510 --> 00:01:19,520
scientists had a hunch that satellite

28
00:01:22,950 --> 00:01:21,520
observations could do the same for

29
00:01:26,550 --> 00:01:22,960
bathymetry

30
00:01:29,109 --> 00:01:26,560
the 1970s ushered in a new era of global

31
00:01:31,910 --> 00:01:29,119
maritime trade and an unprecedented

32
00:01:34,950 --> 00:01:31,920
demand for crude oil resulting in the

33
00:01:37,590 --> 00:01:34,960
design of ultra large crude carriers or

34
00:01:41,429 --> 00:01:37,600
super tankers capable of carrying up to

35
00:01:43,830 --> 00:01:41,439
30 times more oil than previous tankers

36
00:01:45,990 --> 00:01:43,840
just one of these massive ships could

37
00:01:48,710 --> 00:01:46,000
cause a catastrophic environmental

38
00:01:51,510 --> 00:01:48,720

disaster spilling millions of gallons of

39
00:01:53,030 --> 00:01:51,520
crude oil if they ran aground

40
00:01:55,109 --> 00:01:53,040
a leading voice of marine

41
00:01:56,389 --> 00:01:55,119
environmentalism at the time was jacques

42
00:01:59,270 --> 00:01:56,399
cousteau

43
00:02:01,109 --> 00:01:59,280
the world's most famous aquanaut he

44
00:02:03,990 --> 00:02:01,119
expanded the growing conservation

45
00:02:05,910 --> 00:02:04,000
awareness from the land to the seas and

46
00:02:07,590 --> 00:02:05,920
set the groundwork for the ocean

47
00:02:09,990 --> 00:02:07,600
environmental movement

48
00:02:12,229 --> 00:02:10,000
the newly launched landsat satellites

49
00:02:14,550 --> 00:02:12,239
provided a new vantage point from above

50
00:02:17,670 --> 00:02:14,560
and opened up a world of possibilities

51
00:02:19,270 --> 00:02:17,680
for ocean monitoring from space

52
00:02:21,510 --> 00:02:19,280
through george lowe the deputy

53
00:02:24,070 --> 00:02:21,520
administrator of nasa cousteau connected

54
00:02:27,589 --> 00:02:24,080
with russell schweikart a former apollo

55
00:02:29,430 --> 00:02:27,599
9 skylab astronaut together the aquanaut

56
00:02:31,750 --> 00:02:29,440
and the astronaut embarked on a

57
00:02:33,830 --> 00:02:31,760
three-week long expedition to find out

58
00:02:36,790 --> 00:02:33,840
whether landsat satellites could make

59
00:02:38,949 --> 00:02:36,800
accurate bathymetry measurements

60
00:02:40,630 --> 00:02:38,959
a team was assembled cousteau and his

61
00:02:43,030 --> 00:02:40,640
experienced divers

62
00:02:45,830 --> 00:02:43,040
rusty schweichart a jet flying scuba

63
00:02:48,790 --> 00:02:45,840

diving astronaut nasa and university

64
00:02:51,509 --> 00:02:48,800
scientists and the president's son jack

65
00:02:53,750 --> 00:02:51,519
ford an experienced scuba diver

66
00:02:55,350 --> 00:02:53,760
but they still needed a radio operator

67
00:02:57,910 --> 00:02:55,360
to coordinate the experiment's

68
00:03:00,390 --> 00:02:57,920
satellite-based communications

69
00:03:02,470 --> 00:03:00,400
david leichenheim a 23 year old

70
00:03:05,270 --> 00:03:02,480
engineering student overheard a nasa

71
00:03:07,430 --> 00:03:05,280
scientist talking about the position

72
00:03:10,470 --> 00:03:07,440
and i raised my hand and said i'll leave

73
00:03:12,470 --> 00:03:10,480
tomorrow i was first to go to goddard

74
00:03:14,710 --> 00:03:12,480
space flight center and get some

75
00:03:17,990 --> 00:03:14,720
training on the gear that was on the

76
00:03:19,190 --> 00:03:18,000
calypso as a radio slash communications

77
00:03:22,149 --> 00:03:19,200
engineer

78
00:03:25,350 --> 00:03:22,159
the calypso was a 1942

79
00:03:28,710 --> 00:03:25,360
wooden mine sweeper very narrow and

80
00:03:30,630 --> 00:03:28,720
maximum speed was 10 knots was very slow

81
00:03:33,270 --> 00:03:30,640
but the ship did what it was supposed to

82
00:03:36,550 --> 00:03:33,280
do it was equipped with a mobile

83
00:03:39,030 --> 00:03:36,560
laboratory or underwater research and

84
00:03:40,630 --> 00:03:39,040
also had a lot of satellite gear for

85
00:03:43,750 --> 00:03:40,640
communications

86
00:03:46,550 --> 00:03:43,760
so i had some training for a week or two

87
00:03:49,430 --> 00:03:46,560
figuring out orbits and locations of the

88
00:03:53,990 --> 00:03:49,440

satellites and then i was off to

89
00:03:58,229 --> 00:03:56,149
david met cousteau and his team as they

90
00:04:00,309 --> 00:03:58,239
prepared the calypso to set sail for the

91
00:04:02,470 --> 00:04:00,319
bahama islands

92
00:04:04,710 --> 00:04:02,480
there the clear waters of the western

93
00:04:08,070 --> 00:04:04,720
atlantic provided the perfect test site

94
00:04:11,670 --> 00:04:08,080
for measuring water depth from space

95
00:04:14,149 --> 00:04:11,680
eventually we moved to the bahama area

96
00:04:16,069 --> 00:04:14,159
to do this landsat coordinated effort

97
00:04:18,069 --> 00:04:16,079
with another research vessel called the

98
00:04:19,990 --> 00:04:18,079
biandan

99
00:04:22,950 --> 00:04:20,000
beautiful sailboat actually it was

100
00:04:25,510 --> 00:04:22,960
outfitted for scientific experiments

101
00:04:28,710 --> 00:04:25,520
such as water salinity tests and whatnot

102
00:04:30,790 --> 00:04:28,720
so they followed the calypso around

103
00:04:33,189 --> 00:04:30,800
pretty much all of the bahamas where we

104
00:04:36,230 --> 00:04:33,199
were coordinating with landsat

105
00:04:37,110 --> 00:04:36,240
beyond then calypso the divers all this

106
00:04:40,390 --> 00:04:37,120
was

107
00:04:42,870 --> 00:04:40,400
part of this coordinated plan

108
00:04:44,950 --> 00:04:42,880
my role on a daily basis was morning and

109
00:04:47,990 --> 00:04:44,960
afternoon i would give the captain a

110
00:04:50,390 --> 00:04:48,000
polaroid that had a picture of the local

111
00:04:52,790 --> 00:04:50,400
area showing any weather patterns that

112
00:04:55,189 --> 00:04:52,800
might have cropped up in addition to

113
00:04:57,670 --> 00:04:55,199

that my job was to ensure good

114
00:05:01,189 --> 00:04:57,680
communications between the zodiacs that

115
00:05:04,390 --> 00:05:01,199
the divers were on the beyond then also

116
00:05:07,029 --> 00:05:04,400
rusty schweikart who flew the nasa t-38

117
00:05:09,749 --> 00:05:07,039
jet at high altitude and i would

118
00:05:11,749 --> 00:05:09,759
coordinate with the landsat group via

119
00:05:14,469 --> 00:05:11,759
goddard space flight center all those

120
00:05:21,060 --> 00:05:14,479
things had to be coordinated closely for

121
00:05:25,430 --> 00:05:22,390
[Music]

122
00:05:27,590 --> 00:05:25,440
once in position the calypso and biondan

123
00:05:29,909 --> 00:05:27,600
recorded the water's depth using their

124
00:05:32,070 --> 00:05:29,919
sonar

125
00:05:34,710 --> 00:05:32,080
then as a landsat satellite passed

126
00:05:39,270 --> 00:05:34,720
overhead the ships and diving teams made

127
00:05:41,029 --> 00:05:39,280
a series of precisely timed measurements

128
00:05:44,070 --> 00:05:41,039
as cousteau's chief diver for the

129
00:05:45,830 --> 00:05:44,080
expedition bernard delamont recalls by

130
00:05:48,870 --> 00:05:45,840
the radio we get the information of

131
00:05:50,710 --> 00:05:48,880
calipso who said go now

132
00:05:52,310 --> 00:05:50,720
that was the signal for the zodiac

133
00:05:59,909 --> 00:05:52,320
divers to start making their

134
00:05:59,919 --> 00:06:09,189
visibility horizontally

135
00:06:14,230 --> 00:06:11,830
each night the boats sailed 90 nautical

136
00:06:15,670 --> 00:06:14,240
miles westward to the next experiment

137
00:06:17,510 --> 00:06:15,680
site

138
00:06:19,350 --> 00:06:17,520

and were ready to take new measurements

139
00:06:22,710 --> 00:06:19,360
when landsat passed overhead in the

140
00:06:27,350 --> 00:06:25,270
after deciding where we would position

141
00:06:30,150 --> 00:06:27,360
the ships we would move throughout the

142
00:06:33,270 --> 00:06:30,160
area we were in nassau we were aluthra

143
00:06:35,600 --> 00:06:33,280
northwest channel bimini berry islands

144
00:06:37,510 --> 00:06:35,610
we would hopscotch back and forth

145
00:06:39,350 --> 00:06:37,520
[Music]

146
00:06:41,670 --> 00:06:39,360
with the detailed measurements taken by

147
00:06:43,909 --> 00:06:41,680
cousteau and his team nasa scientists

148
00:06:46,230 --> 00:06:43,919
demonstrated that in similar conditions

149
00:06:50,629 --> 00:06:46,240
depths of up to 72 feet could be

150
00:06:55,430 --> 00:06:53,110
those early satellite-derived bathymetry

151
00:06:57,830 --> 00:06:55,440
measurements revealed previously unknown

152
00:06:59,990 --> 00:06:57,840
shoals uncharted reefs and other

153
00:07:02,550 --> 00:07:00,000
navigational hazards and also helped

154
00:07:05,270 --> 00:07:02,560
revise charts of clear water coastal

155
00:07:06,390 --> 00:07:05,280
areas making sailing safer around the

156
00:07:08,430 --> 00:07:06,400
world

157
00:07:10,790 --> 00:07:08,440
this work gave birth to the field of

158
00:07:13,110 --> 00:07:10,800
satellite-derived bathymetry and the

159
00:07:16,550 --> 00:07:13,120
field continues to evolve today with

160
00:07:18,710 --> 00:07:16,560
missions like icesat 2.

161
00:07:21,990 --> 00:07:18,720
the experiment also had a profound

162
00:07:25,990 --> 00:07:24,950
this expedition changed my life

163
00:07:28,629 --> 00:07:26,000

i

164
00:07:31,270 --> 00:07:28,639
returned to maryland and then got a job

165
00:07:36,710 --> 00:07:31,280
at goddard space flight center

166
00:07:41,749 --> 00:07:39,749
since 1972 landsat satellites have been

167
00:07:43,830 --> 00:07:41,759
steadfast observers of our changing

168
00:07:48,390 --> 00:07:43,840
planet making more and better

169
00:07:52,390 --> 00:07:50,550
landsat 9 the newest satellite in the

170
00:07:54,790 --> 00:07:52,400
series will continue recording the

171
00:07:58,270 --> 00:07:54,800
spectral story of earth's ever-changing

172
00:08:24,530 --> 00:07:58,280
land surfaces and coastal waters