1
00:00:00,000 --> 00:00:03,000
(clock ticking)

2
00:00:03,000 --> 00:00:05,000
NARRATOR: Time.

3
00:00:05,000 --> 00:00:07,000
It seems to rule everything we do.

4
00:00:07,000 --> 00:00:11,000
Yet have you ever really thought about how important time is to us?

5
00:00:11,000 --> 00:00:14,000
You see, sitting amidst the hours and minutes of our day

6
00:00:14,000 --> 00:00:16,000
is our forgotten little friend -

7
00:00:16,000 --> 00:00:18,000
Sammy the Second. (drum roll)

8
00:00:18,000 --> 00:00:20,000
(crickets chirping)

9
00:00:20,000 --> 00:00:24,000
Often overlooked, Sammy really is, not only the heartbeat of time,

10
00:00:24,000 --> 00:00:27,000
but he plays a crucial part in another area of human progress-

11
00:00:27,000 --> 00:00:30,000
navigation.

12
00:00:30,000 --> 00:00:33,000
But what does time have to do with navigation you ask?

13
00:00:33,000 --> 00:00:36,000

Well, got a SECOND to find out?

14
00:00:36,000 --> 00:00:38,000
(drum hits and cymbal) (mwah-mwah trumpet)

15
00:00:38,000 --> 00:00:41,000
(harp strings) It all began long ago when sea explorers carried clocks on board their ships

16
00:00:41,000 --> 00:00:43,000
called 'Chronometers.'

17
00:00:43,000 --> 00:00:47,000
These clocks were set to the exact time as a clock back on land.

18
00:00:47,000 --> 00:00:51,000
And together with observing the sun, moon and stars,

19
00:00:51,000 --> 00:00:54,000
they could determine their longitude and latitude.

20
00:00:54,000 --> 00:00:56,000
This process aloud maps to be drawn

21
00:00:56,000 --> 00:00:59,000
so other ships could know where they were going. Amazing!

22
00:00:59,000 --> 00:01:00,000
(Whistling)

23
00:01:00,000 --> 00:01:02,000
(SMACK)

24
00:01:02,000 --> 00:01:03,000
(splash) However,

25
00:01:03,000 --> 00:01:05,000
clocks back then weren't very accurate

26
00:01:05,000 --> 00:01:09,000
and if a ships chronometer drifted off by even a few 'Sammys' from the main clock,

27
00:01:09,000 --> 00:01:11,000
it could mean the difference between finding their destination-

28
00:01:11,000 --> 00:01:13,000
(people cheering)

29
00:01:13,000 --> 00:01:15,000
- and being hopelessly lost.

30
00:01:15,000 --> 00:01:17,000
(falling) (scream)

31
00:01:17,000 --> 00:01:18,000
Today

32
00:01:18,000 --> 00:01:23,000
time is a precise part of a type of navigation called the 'Global Positioning System'

33
00:01:23,000 --> 00:01:24,000
or GPS.

34
00:01:24,000 --> 00:01:30,000
Yes- boats, planes, cars and even our very own smart phones receive data back from orbiting satellites

35
00:01:30,000 --> 00:01:34,000
that calculate our longitude and latitude coordinates.

36
00:01:34,000 --> 00:01:37,000
This allows you to arrive at a destination within feet!

37
00:01:37,000 --> 00:01:38,000
(car screech)

38
00:01:38,000 --> 00:01:39,000

CHEF: Pizza!

39
00:01:39,000 --> 00:01:41,000
NARRATOR: So you see, down here on earth

40
00:01:41,000 --> 00:01:44,000
it's only because of time... uh, I mean Sammy...

41
00:01:44,000 --> 00:01:47,000
that we can know where we are and where we're going.

42
00:01:47,000 --> 00:01:49,000
(trumpets)

43
00:01:49,000 --> 00:01:51,000
(children cheering)

44
00:01:51,000 --> 00:01:55,000
NARRATOR: But what about in space?

45
00:01:55,000 --> 00:01:56,000
(BONK)

46
00:01:56,000 --> 00:02:00,000
Not just space, but DEEP space.

47
00:02:00,000 --> 00:02:04,000
How do you navigate and explore a place where there are no longitude and latitude lines?

48
00:02:04,000 --> 00:02:06,000
No orbiting satellites to help?

49
00:02:06,000 --> 00:02:09,000
Right now, scientists navigate spacecraft by using giant antennas here on earth.

50
00:02:09,000 --> 00:02:11,000
(wobble sounds)

51
00:02:11,000 --> 00:02:13,000
(laughs) No, not those kind.

52
00:02:13,000 --> 00:02:15,000
THESE kind.

53
00:02:15,000 --> 00:02:17,000
(distant hawk screech)

54
00:02:17,000 --> 00:02:21,000
Just like the old sea explorers, and our GPS,

55
00:02:21,000 --> 00:02:25,000
these antennas send out a signal that is bounced off the spacecraft- straight back to the earth.

56
00:02:25,000 --> 00:02:28,000
Scientists then measure the time it took for this round trip- (whoosh)

57
00:02:28,000 --> 00:02:32,000
- and that's what determines the spacecrafts distance and speed.

58
00:02:32,000 --> 00:02:35,000
While bouncing signals off of our spacecraft works (trumpets)

59
00:02:35,000 --> 00:02:38,000
it isn't the most efficient way to navigate deep space. (dismal trumpet)

60
00:02:38,000 --> 00:02:43,000
You see, the antenna can only talk to one spacecraft at a time leaving others waiting up to a day.

61
00:02:43,000 --> 00:02:44,000
(traffic horns honking)

62
00:02:44,000 --> 00:02:47,000
And then by the time the signals calculated and sent back

63
00:02:47,000 --> 00:02:51,000

the spacecraft isn't in the same spot anymore and the results have to be adjusted. (buzzer)

64
00:02:51,000 --> 00:02:57,000
So, how can deep space exploration become even more efficient, exact and precise?

65
00:02:57,000 --> 00:03:01,000
How can a spacecrafts navigation, as it travels further and further into space

66
00:03:01,000 --> 00:03:04,000
be more immediate and independent of having to check in with-

67
00:03:04,000 --> 00:03:06,000
-what's that Sammy?

68
00:03:06,000 --> 00:03:07,000
(SMASH)

69
00:03:07,000 --> 00:03:10,000
Of course! The Deep Space Atomic Clock! (pop)

70
00:03:10,000 --> 00:03:15,000
Scientists and engineers have now developed a way for the spacecraft to have its own on-board clock

71
00:03:15,000 --> 00:03:18,000
so it no longer has to check in with earth for its coordinates.

72
00:03:18,000 --> 00:03:24,000
This breakthrough device is smaller, self-sufficient, and can handle the harsh conditions of deep space.

73
00:03:24,000 --> 00:03:28,000
Now the spacecraft can make immediate course corrections on its own!

74
00:03:28,000 --> 00:03:33,000
And land with incredible precision!

75
00:03:33,000 --> 00:03:37,000
So you see, our little friend Sammy the Second is finally getting his due-

76
00:03:37,000 --> 00:03:41,000
paving the way for more precise and efficient space exploration-

77
00:03:41,000 --> 00:03:44,000
one tick, tock, tick at a time!

78
00:03:44,000 --> 00:03:47,000
(crowd applause)