1
00:00:01,266 --> 00:00:03,246
>> Thanks Brandi, [background
noise] we're back here in the Anthropometry

2
00:00:03,246 --> 00:00:04,796
and Biomechanics, did I get it right?

3
00:00:04,886 --> 00:00:05,656
Biomechanics Facility?

4
00:00:05,656 --> 00:00:06,816
It's a very long word.

5
00:00:06,916 --> 00:00:08,716
We're back with Amy Ross,
the Space Suit Engineer.

6
00:00:08,716 --> 00:00:10,966
Now, you saw before that we
have a suit up on the rack.

7
00:00:10,966 --> 00:00:12,786
They've actually got Dick Watson in there now.

8
00:00:13,106 --> 00:00:14,476
He's pressurized and now he's walking.

9
00:00:14,586 --> 00:00:16,786
So talk about this setup
about what we're about to see.

10
00:00:16,866 --> 00:00:19,716
>> All right, so the ABF
has Vicon camera system.

11
00:00:20,306 --> 00:00:20,496
>> Okay.

12

00:00:20,896 --> 00:00:24,866
>> So it's an infrared system that
reflects off the little markers on the suit.

13
00:00:24,866 --> 00:00:26,846
So we put a little reflector
markers on the suit.

14
00:00:26,846 --> 00:00:28,106
>> There's dozens of them on there.

15
00:00:28,246 --> 00:00:29,676
>> And so, he's-- look at the screen,

16
00:00:29,966 --> 00:00:33,766
you can see how the cameras see
the suit with those markers.

17
00:00:34,576 --> 00:00:40,586
And what the ABF like Liz Vinson [phonetic]
here does is they can take those marker sets

18
00:00:41,366 --> 00:00:43,956
and analyze motion in the suits.

19
00:00:43,996 --> 00:00:46,396
So we can understand, say
elbow range in motion--

20
00:00:46,976 --> 00:00:47,096
>> Yeah.

21
00:00:47,096 --> 00:00:51,706
>> -- or knee range in motion or how-- if you're
kneeling, what joints you're using and how much?

22
00:00:52,396 --> 00:00:56,226
So it really gives us a lot of information
about not only the gross mobility the suit

23
00:00:56,226 --> 00:00:59,666
but how each individual component of the
suit contributes to overall mobility.

24
00:00:59,916 --> 00:01:04,366
>> Now, people that have seen the movie Avatar
or seen Lord of the Rings or any of those,

25
00:01:04,366 --> 00:01:05,886
Nobiz [phonetic] has motion capture, right?

26
00:01:05,956 --> 00:01:06,776
Same technology--

27
00:01:06,776 --> 00:01:07,286
>> Same technology.

28
00:01:07,576 --> 00:01:11,726
>> How-- talk about how much that helps, you
guys designed these suits, what does it do?

29
00:01:12,046 --> 00:01:15,096
>> So it really helps us a lot because
I used to have to do measurements

30
00:01:15,206 --> 00:01:19,036
where I'd have the person do as far back as
they can here, as far back as they can here--

31
00:01:19,036 --> 00:01:19,376
>> And measure it.

32
00:01:19,376 --> 00:01:20,806
>> I just took pictures and measured it.

33
00:01:20,896 --> 00:01:21,016
>> Yeah.

34

00:01:21,266 --> 00:01:23,386
>> And now, I can have them do functional tasks.

35
00:01:23,386 --> 00:01:27,856
I actually understand which joints they use and
how much that joint contributes to the motion.

36
00:01:28,106 --> 00:01:29,266
>> Now, we're seeing little white dots here.

37
00:01:29,266 --> 00:01:31,456
Then you guys showed us this
before we came on the air bed.

38
00:01:31,666 --> 00:01:35,756
They actually build kind of a skeleton
model then kind of a false suit, right?

39
00:01:35,856 --> 00:01:40,846
>> Yeah, so you know, it's a little bit hard if
he move, you kind of tell an arm when he moves.

40
00:01:40,996 --> 00:01:46,636
But they can feel the framework that can show
the different segments of the body better.

41
00:01:46,636 --> 00:01:50,856
So you can see an arm, you can see the torso,
and you can see the legs, more than making it

42
00:01:50,856 --> 00:01:52,156
up out of the consolation of dots.

43
00:01:52,546 --> 00:01:55,826
>> You can actually see in the computer
from all angles how he actually moves

44
00:01:55,826 --> 00:01:57,066
and how the suit really does operate.

45
00:01:57,226 --> 00:01:57,376
>> Yeah.

46
00:01:57,996 --> 00:02:00,546
>> Now, you guys were saying that
this is down to a millimeter?

47
00:02:00,736 --> 00:02:04,046
You can-- the cameras can sense almost
down to just, you know, just a hair.

48
00:02:04,386 --> 00:02:06,166
>> We have a lot better accuracy
than we used to.

49
00:02:06,166 --> 00:02:08,606
You know, we looked at motion
capture back in the late '90's

50
00:02:08,926 --> 00:02:11,336
and it just couldn't give us
the kind of data that we wanted

51
00:02:11,386 --> 00:02:12,826
for the space suit design to work.

52
00:02:13,496 --> 00:02:17,036
So it did-- motion captured
for video games didn't help us

53
00:02:17,126 --> 00:02:18,536
for space suit design, now it does.

54
00:02:18,836 --> 00:02:20,926
>> Yeah and the green boxes
actually represent the cameras.

55
00:02:20,926 --> 00:02:22,686
How many of those-- what,

8 cameras I guess up here?

56
00:02:23,486 --> 00:02:23,966
>> Yeah, 8 Cameras.

57
00:02:24,036 --> 00:02:24,436
>> 8 Cameras.

58
00:02:25,446 --> 00:02:26,926
>> This is-- I mean, this is
very impressive to see this.

59
00:02:26,956 --> 00:02:27,506
Now, what's happening?

60
00:02:27,576 --> 00:02:29,036
What is it doing?

61
00:02:29,126 --> 00:02:32,126
>> It's actually the [inaudible] which of
the cameras can see each of the markers.

62
00:02:32,516 --> 00:02:32,686
>> Okay.

63
00:02:32,686 --> 00:02:35,866
>> So if you see red coming from the camera,
it can see that marker in its individual view.

64
00:02:36,406 --> 00:02:38,636
>> Okay, so the cameras are
actually picking up on

65
00:02:38,636 --> 00:02:41,096
that one specific marker,
the blue that you see there.

66
00:02:41,386 --> 00:02:43,496
>> All right, but you can probably

check to make sure that your--

67
00:02:43,626 --> 00:02:47,926
you got enough cameras to get the 3D and
the thing that we want for any body part.

68
00:02:48,746 --> 00:02:51,446
>> So how long will this test go on today, I
mean how long is he going to be in the suit?

69
00:02:52,406 --> 00:02:55,996
>> We've been able to get this test to be
pretty efficient, so this test only takes

70
00:02:56,056 --> 00:02:57,886
about an hour, hour and a half now.

71
00:02:58,216 --> 00:03:02,816
We used to spend three hours doing this
test and we used to spend even longer

72
00:03:02,816 --> 00:03:04,356
and then the data analysis took months.

73
00:03:04,936 --> 00:03:08,416
Whereas now, Liz can give us some
numbers pretty quickly which is one

74
00:03:08,416 --> 00:03:10,786
of the real benefits of the updated technology.

75
00:03:11,166 --> 00:03:13,076
>> So to, you know, to the
layman, what do you guys do?

76
00:03:13,156 --> 00:03:16,656
Do you record this and you go back and
you take a look at it later on, right?

77

00:03:16,696 --> 00:03:18,356
You're just looking at range
of motion measurement.

78
00:03:19,076 --> 00:03:21,466
Do you go back and compare
different tests to each other

79
00:03:21,636 --> 00:03:22,936
and then see how it's improved [inaudible]?

80
00:03:22,936 --> 00:03:23,386
>> Some, yeah.

81
00:03:23,506 --> 00:03:31,486
One of the main things we do is we look
at how the person can move without a suit

82
00:03:31,766 --> 00:03:36,526
on versus how he can move with a suit.

83
00:03:36,926 --> 00:03:37,026
>> Okay.

84
00:03:37,026 --> 00:03:40,306
>> So we can understand how much
the suit does or does not allow them

85
00:03:40,526 --> 00:03:42,776
to move and say we'd [inaudible]--

86
00:03:43,006 --> 00:03:46,456
>> It either inhibits them or helps someone.

87
00:03:46,806 --> 00:03:46,986
>> Right.

88
00:03:46,986 --> 00:03:47,256
>> Interesting.

89
00:03:47,296 --> 00:03:47,466
>> Right.

90
00:03:47,466 --> 00:03:50,856
>> So do you do walking and bending--

91
00:03:50,916 --> 00:03:57,156
>> Yeah, we try to look at the variety of
motions so we did some isolated stuff and just--

92
00:03:57,156 --> 00:04:00,326
exercises individual joints to their maximum.

93
00:04:00,456 --> 00:04:03,616
>> Like he's picking up something right now.

94
00:04:03,776 --> 00:04:08,416
>> But then, we do kneeling, walking,
crawling, so we really try to give some tasks

95
00:04:08,416 --> 00:04:10,516
that might be realistic for EVA or some tasks

96
00:04:10,516 --> 00:04:13,306
that we just know really
exercises him in a while.

97
00:04:13,896 --> 00:04:14,666
>> Now this is fascinating.

98
00:04:14,666 --> 00:04:18,096
I mean, is there-- I mean, it's very cool
and I should see this, you know, in reality

99
00:04:18,126 --> 00:04:19,596
and see you guys actually, you know,
building a suit [inaudible] like this.

100
00:04:19,626 --> 00:04:21,156
It's quite impressive the amount
of effort that goes under this.

101
00:04:21,186 --> 00:04:22,986
>> Well this year is very exciting
'cause we do have lot of testing going

102
00:04:23,016 --> 00:04:24,756
on 'cause we're really trying to
understand how the suit moves and works

103
00:04:24,786 --> 00:04:26,346
so we can make those decisions
for the next configuration.

104
00:04:26,376 --> 00:04:28,746
>> Yeah, well if you guys want to take a look at
the space suit development and see some pictures

105
00:04:28,776 --> 00:04:30,246
and some of these or anything
like that, you can always log

106
00:04:30,276 --> 00:04:32,406
on to the NASA website which is at www.nasa.gov.

107
00:04:32,436 --> 00:04:32,976
Amy, thank you so much--

108
00:04:33,006 --> 00:04:33,306
>> You're welcome.