
SPACEX CRS-20
WHAT'S ON BOARD

1
00:00:20,680 --> 00:00:27,370
WITH BARTOLOMEO, WE CAN OFFER 12
PAYLOAD SLOTS AVAILABLE FOR ANY

2
00:00:27,370 --> 00:00:28,360
ORGANIZATION.

3
00:00:28,390 --> 00:00:33,105
BE IT A RESEARCH ORGANIZATION,
UNIVERSITY, OR A COMMERCIAL

4
00:00:33,435 --> 00:00:34,155
ENTITY.

5
00:00:34,185 --> 00:00:38,805
IT'S, IT'S SOMETHING THAT WILL
ENHANCE THE, UH, CAPABILITIES TO

6
00:00:38,805 --> 00:00:43,065
PERFORM EXTERNAL RESEARCH ON THE
SPACE STATION, GIVING GREATER

7
00:00:43,065 --> 00:00:45,435
QUANTITIES OF PAYLOAD SLOTS.

8
00:00:45,525 --> 00:00:49,695
OUR NASA COLLEAGUES FROM THE
ROBOTICS TEAM HAVE TOLD US THIS

9
00:00:49,695 --> 00:00:53,775
IS THE MOST COMPLEX, UH,
EXPERIMENT PLATFORM THEY'VE EVER

10
00:00:53,775 --> 00:00:58,725
SEEN THE HANDLING OF THE DATA
AND POWER IS DONE VIA THESE WHITE

11
00:00:58,825 --> 00:00:59,895
AVIONIC BOXES.

12
00:00:59,925 --> 00:01:04,065
ONE IS RESPONSIBLE FOR GETTING
THE POWER FROM THE COLUMBUS AND

13
00:01:04,065 --> 00:01:07,275
DISTRIBUTING IT TO THE
INDIVIDUAL PAYLOADS.

14
00:01:07,335 --> 00:01:11,115
THEY CAN BE CONTROLLED
INDIVIDUALLY SO THAT EACH PAYLOAD

15
00:01:11,115 --> 00:01:12,645
HAS ITS OWN POWER SUPPLY.

16
00:01:13,560 --> 00:01:16,560
SAME APPLIES FOR THE DATA
HANDLING SYSTEM, WHICH IS THE

17
00:01:16,560 --> 00:01:21,750
SECOND OF AVIONIC BOX WITH THE
AVIONIC SYSTEM, WE ACQUIRE THE

18
00:01:21,750 --> 00:01:28,410
HOUSEKEEPING AND A PAYLOAD DATA
FROM THE PAYLOAD SLOT AND SEND

19
00:01:28,410 --> 00:01:32,940
THEM VIA THE COLUMBUS TELEMETRIC
SYSTEM, THE ISS TELEMETRY TO THE

20
00:01:32,940 --> 00:01:33,419
GROUND.

21
00:01:33,600 --> 00:01:36,359
IT'S GOING TO BE ATTACHED
TO THE COLUMBUS MODULE.

22

00:01:36,419 --> 00:01:39,989
IT HAS SOME OF THE BEST VIEWING
CAPABILITIES ON THE STATION SO

23
00:01:40,350 --> 00:01:42,740
YOU'RE OUT FRONT
LEADING EDGE, RAM.

24
00:01:42,989 --> 00:01:44,759
IT'S IN THE SWEET SPOT.

25
00:01:46,050 --> 00:01:49,990
WE WANTED TO STUDY IF HEART
SPECIFIC STEM CELL CALLED CARDIAC

26
00:01:50,039 --> 00:01:55,500
PROGENITORS CAN GROW FASTER IN
SPACE, AND IF MORE OF THEM CAN

27
00:01:55,500 --> 00:02:00,419
TURN INTO A BEATING HEART MUSCLE
CELLS KNOWN AS A CARDIOMYOCYTES.

28
00:02:00,660 --> 00:02:04,470
SO THIS IS THE CARDIOMYOCYTES
THAT WE GENERATED FROM STEM CELLS

29
00:02:04,470 --> 00:02:05,340
IN OUR LAB.

30
00:02:05,820 --> 00:02:10,650
UH, THE STEM CELL CARDIOMYOCYTES
HAVE GREAT POTENTIAL TO TREAT

31
00:02:10,650 --> 00:02:13,410
HEART DISEASE FOR
BOTH KIDS AND ADULTS.

32
00:02:13,859 --> 00:02:17,680
STEM CELL THERAPIES, UH, FOR

REPAIRING OUR HEART, DAMAGED

33
00:02:17,700 --> 00:02:22,170
HEART, ACTUALLY REQUIRES A LARGE
NUMBER OF CARDIOMYOCYTES, AT

34
00:02:22,170 --> 00:02:24,690
LEAST ONE BILLION
FOR EACH PATIENT.

35
00:02:25,590 --> 00:02:30,120
SO WE NEED TO DEVELOP A MORE
EFFICIENT WAYS TO PRODUCE THESE

36
00:02:30,120 --> 00:02:32,460
CELLS THAN CURRENTLY POSSIBLE.

37
00:02:33,179 --> 00:02:37,980
WHEN WE COMBINE OUR 3D TISSUE
ENGINEERING WITH SIMULATED

38
00:02:37,980 --> 00:02:43,020
MICROGRAVITY WE SAW PROMISING
STEPS TOWARDS REACHING THAT GOAL.

39
00:02:43,080 --> 00:02:47,760
IN SENDING THE CELL TO SPACE, WE
WOULD LIKE TO, UH, CONFIRM OUR

40
00:02:47,950 --> 00:02:49,410
GROUND BASED OBSERVATION.

41
00:02:49,590 --> 00:02:52,320
SO INSIDE THIS BOX WE
HAVE YOUR WHOLE LAB.

42
00:02:52,770 --> 00:02:54,480
WE HAVE YOUR SUPPLY MEDIA.

43

00:02:54,870 --> 00:02:57,720
WE HAVE YOUR ALREADY USED MEDIA.

44
00:02:58,200 --> 00:03:01,620
WE HAVE PUMPS, WE CAN DO
INCUBATION, WE HAVE A MICROSCOPE,

45
00:03:01,620 --> 00:03:03,600
AND FINALLY WE HAVE A CHAMBER
THAT WE CAN GROW THE CELLS IN.

46
00:03:03,600 --> 00:03:07,890
SO ALL THIS INTEGRATED, YOU KNOW,
IN A, IN A HAND SIZED PACKAGE IS

47
00:03:07,890 --> 00:03:09,720
WHAT WOULD TAKE A WHOLE
BENCH TOP IN YOUR LAB.

48
00:03:09,750 --> 00:03:11,490
WE'RE TRYING A COUPLE OF
NEW THINGS ON THIS FLIGHT.

49
00:03:11,520 --> 00:03:12,750
WE'RE BRINGING THESE BACK ALIVE.

50
00:03:12,930 --> 00:03:15,900
WHILE WE'LL PRESERVE SOME OF THE
CELLS ON STATION IS REALLY THOSE

51
00:03:15,900 --> 00:03:18,720
LIVE CELLS AND RETURN TO REALLY
UNDERSTAND WHAT'S GOING ON AND TO

52
00:03:18,720 --> 00:03:22,215
REALLY UNDERSTAND WHAT'S GOING ON
WHEN THEY REACCLIMATE TO 1 G TO

53
00:03:22,215 --> 00:03:23,635
SAY, YOU KNOW, DID WE

MULTIPLY THE CELLS?

54
00:03:23,655 --> 00:03:25,305
BUT DID WE MULTIPLY
THEM THE RIGHT WAY?

55
00:03:25,815 --> 00:03:28,605
SO WHEN YOU ASK PEOPLE WHAT THEY
WANT IN A SHOWER, VIRTUALLY EVERY

56
00:03:28,635 --> 00:03:29,895
WILL SAY THEY WANT MORE PRESSURE.

57
00:03:30,525 --> 00:03:32,775
FROM A TECHNICAL PERSPECTIVE,
THE PRESSURE IS ZERO.

58
00:03:32,775 --> 00:03:35,955
ONCE IT LEAVES THE PIPE, THERE IS
NO PRESSURE, BUT THEY'RE ACTUALLY

59
00:03:35,955 --> 00:03:39,675
FEELING IS THE MOMENTUM OF THE
DROPS HITTING THEIR BODIES.

60
00:03:40,095 --> 00:03:40,395
RIGHT.

61
00:03:40,695 --> 00:03:44,565
SO THE MASS, OR I'M SORRY, THE
MOMENTUM IS THE MASS TIMES THE

62
00:03:44,565 --> 00:03:45,105
VELOCITY.

63
00:03:45,630 --> 00:03:47,880
SO IF YOU CAN MAKE THEM BIGGER
AND MAKE THEM FASTER WHEN THEY

64

00:03:47,880 --> 00:03:49,440
HIT YOU, YOU'RE GOING
TO FEEL IT MORE.

65
00:03:50,040 --> 00:03:55,000
SO OUR TESTING WE'VE DONE AND
IMPROVE THAT WE CAN GET ABOUT, IT

66
00:03:55,020 --> 00:03:56,640
FEELS LIKE THREE
TIMES MORE WATER.

67
00:03:56,700 --> 00:03:59,580
AND THEN ALSO WHAT YOU'RE GETTING
IS BECAUSE IT ACTUALLY COVERS AN

68
00:03:59,580 --> 00:04:02,260
AREA AS OPPOSED TO JUST LIKE A
NEEDLE JET, WHICH IS JUST ONE

69
00:04:02,510 --> 00:04:04,650
LITTLE LINE OF WATER HITTING YOU.

70
00:04:04,830 --> 00:04:08,280
WE GET ABOUT A 90, 95% COVERAGE
OF WATER ACTUALLY HITTING YOU

71
00:04:08,760 --> 00:04:12,330
VERSUS A TYPICAL SHOWER HEAD
WHERE YOU MIGHT HAVE 44, 66

72
00:04:12,330 --> 00:04:14,340
NOZZLE JETS HITTING
YOU IS ABOUT 25%.

73
00:04:14,775 --> 00:04:17,325
SO YOU GET BIGGER AREA AND
THE DROPLETS ARE BIGGER.

74
00:04:17,565 --> 00:04:20,985

SO AS WE GET A BETTER
UNDERSTANDING OF THAT, HOW THAT

75
00:04:20,985 --> 00:04:25,755
ON A MICROGRAVITY WORKS, WE'RE
HOPEFUL THAT WE CAN COME UP WITH

76
00:04:25,815 --> 00:04:29,055
JUST A TWEAK OR DO THIS
DIFFERENTLY, OR A DROPLET MIGHT

77
00:04:29,055 --> 00:04:30,284
BE CIRCULAR.

78
00:04:30,284 --> 00:04:34,455
NOW WE MAKE IT, YOU KNOW, OBLONG
OR WHATEVER ELSE THAT WILL HELP

79
00:04:34,455 --> 00:04:39,705
US CONTINUE TO DEAL WITH THE
LOWER FLOW RATE AND ALSO WITH THE

80
00:04:39,735 --> 00:04:40,725
CONSERVING WATER.

81
00:04:41,835 --> 00:04:46,335
WHAT WE SET OUT TO DO WAS TO WORK
WITH THE NATIONAL LAB TO DEVELOP

82
00:04:46,335 --> 00:04:49,335
A PLATFORM THAT WOULD ALLOW
SCIENTISTS, ALLOW US, BUT OTHER

83
00:04:49,335 --> 00:04:54,045
CHEMISTS, UH, TO, TO, UH, CARRY
OUT CHEMICAL REACTIONS SAFELY

84
00:04:54,225 --> 00:04:57,225
AND, UH, AND EFFICIENTLY
ON THE SPACE STATION.

85
00:04:57,435 --> 00:05:00,855
IT TURNS OUT THAT THERE'S NOT A
WHOLE LOT KNOWN OR, UH, THERE'S

86
00:05:00,855 --> 00:05:05,179
NOT BEEN A LOT OF EXPLORATION OF
HOW CHEMICAL REACTIONS BEHAVE IN

87
00:05:05,179 --> 00:05:05,919
MICROGRAVITY.

88
00:05:06,260 --> 00:05:09,199
IF I WANTED TO TAKE THE SYSTEM
THAT I'VE BUILT IN MY LAB AND PUT

89
00:05:09,199 --> 00:05:11,960
IT ON THE SPACE STATION, THE
LIKELIHOOD OF IT BEHAVING THE

90
00:05:11,960 --> 00:05:13,099
SAME IS VERY LOW.

91
00:05:13,369 --> 00:05:17,745
AND THE ENGINEERS AT SPACE TANGO
WHERE WE'RE ABLE TO ESSENTIALLY

92
00:05:17,745 --> 00:05:21,975
TAKE THE TECHNOLOGIES THAT WE'VE
DEVELOPED IN THE LAB AND PUT THEM

93
00:05:21,975 --> 00:05:23,175
INTO A VERY SMALL BOX.

94
00:05:23,175 --> 00:05:25,785
AND THIS SYSTEM IS
FAIRLY COMPLEX INSIDE.

95
00:05:25,785 --> 00:05:28,845

IT HAS A NUMBER OF BAGS, A LOT
OF TUBING, A LOT OF PUMPS AND

96
00:05:28,845 --> 00:05:29,415
MANIFOLDS.

97
00:05:29,625 --> 00:05:32,565
WE CAN CONTROL THE SPEED OR
THE RATE OF THE REACTION.

98
00:05:32,865 --> 00:05:36,485
WE CAN CONTROL TEMPERATURE, WE
CAN CONTROL TIME, WE CONTROL ALL

99
00:05:36,505 --> 00:05:37,695
THOSE SORT OF VARIABLES.

100
00:05:37,905 --> 00:05:41,595
AND WE CAN DO UP TO 18 DIFFERENT
REACTIONS WITH UP TO 36

101
00:05:41,595 --> 00:05:45,165
COMBINATIONS OF REAGENTS AND
START TO REALLY LOOK AT THE