1
00:00:19,820 --> 00:00:16,820
the course of this country's future in

2
00:00:23,240 --> 00:00:19,830
space has been set Space Station freedom

3
00:00:26,330 --> 00:00:23,250
in low-earth orbit a permanent base on

4
00:00:38,040 --> 00:00:26,340
the lunar surface and then before the

5
00:00:42,880 --> 00:00:40,779
among many challenges to be met in

6
00:00:45,130 --> 00:00:42,890
achieving these goals is an efficient

7
00:00:47,889 --> 00:00:45,140
reliable way to provide spacefaring

8
00:00:50,740 --> 00:00:47,899
crews with fresh air clean water and

9
00:00:52,689 --> 00:00:50,750
nutritious field carrying enough of

10
00:00:54,639 --> 00:00:52,699
these vital supplies onboard will be

11
00:00:58,539 --> 00:00:54,649
costly and in many cases impossible

12
00:01:00,700 --> 00:00:58,549
especially for lengthy missions seeking

13
00:01:02,740 --> 00:01:00,710

alternatives researchers around the

14
00:01:04,840 --> 00:01:02,750
country including a group at NASA's

15
00:01:07,660 --> 00:01:04,850
Kennedy Space Center Florida are

16
00:01:12,300 --> 00:01:07,670
developing a system where plants recycle

17
00:01:14,580 --> 00:01:12,310
air water and waste and provide food

18
00:01:16,859 --> 00:01:14,590
plants in a water-based nutrient

19
00:01:23,670 --> 00:01:16,869
solution eliminates the need to carry

20
00:01:25,710 --> 00:01:23,680
heavy soil into space the work of dr.

21
00:01:27,649 --> 00:01:25,720
Steve Schwarzkopf an engineer at

22
00:01:29,730 --> 00:01:27,659
Lockheed in Sunnyvale California

23
00:01:31,889 --> 00:01:29,740
demonstrates how important it is to

24
00:01:34,380 --> 00:01:31,899
control the content of nutrient

25
00:01:36,539 --> 00:01:34,390
solutions he's discovering that when

26
00:01:38,850 --> 00:01:36,549
tomatoes and lettuce are grown in the

27
00:01:41,520 --> 00:01:38,860
same solution the lettuce doesn't fare

28
00:01:43,020 --> 00:01:41,530
so well what we do not know yet is

29
00:01:45,330 --> 00:01:43,030
whether this effect is caused by the

30
00:01:47,100 --> 00:01:45,340
tomatoes putting out some kind of a

31
00:01:49,289 --> 00:01:47,110
chemical into the nutrient solution

32
00:01:50,699 --> 00:01:49,299
through the roots or whether it might be

33
00:01:53,340 --> 00:01:50,709
due to the fact that they're taking up

34
00:01:56,240 --> 00:01:53,350
some nutrient that the lettuce needs and

35
00:01:58,410 --> 00:01:56,250
just not letting let us get it

36
00:02:00,779 --> 00:01:58,420
researchers at NASA's Johnson Space

37
00:02:02,910 --> 00:02:00,789
Center in Houston are growing plants in

38
00:02:05,550 --> 00:02:02,920

soils similar to those on the lunar

39
00:02:07,830 --> 00:02:05,560
surface their test chamber allows them

40
00:02:10,320 --> 00:02:07,840
to work at reduced atmospheric pressures

41
00:02:15,240 --> 00:02:10,330
likely to be used in habitats on the

42
00:02:17,250 --> 00:02:15,250
Moon and Mars the JSC team is also

43
00:02:19,160 --> 00:02:17,260
working to adapt physical chemical

44
00:02:21,720 --> 00:02:19,170
systems from the Apollo and shuttle

45
00:02:26,880 --> 00:02:21,730
programs to recycle on the land

46
00:02:28,860 --> 00:02:26,890
breathing air dr. mark cliffs at NASA's

47
00:02:30,930 --> 00:02:28,870
Ames Research Center in Mountain View

48
00:02:33,120 --> 00:02:30,940
California is integrating other

49
00:02:37,830 --> 00:02:33,130
recycling subsystems into a facility

50
00:02:39,240 --> 00:02:37,840
called the solid machine air circulated

51
00:02:42,059 --> 00:02:39,250
through a growth chamber collects

52
00:02:43,770 --> 00:02:42,069
moisture released by leaves this air is

53
00:02:45,660 --> 00:02:43,780
then drawn through an opening and the

54
00:02:48,740 --> 00:02:45,670
rear of the chamber and piped into a

55
00:02:51,090 --> 00:02:48,750
condenser which removes the water

56
00:02:53,879 --> 00:02:51,100
preliminary analyses indicate this

57
00:02:56,910 --> 00:02:53,889
recovered water is drinkable this could

58
00:02:58,740 --> 00:02:56,920
now evolve into a different kind of

59
00:03:01,740 --> 00:02:58,750
system tour perhaps we could utilize

60
00:03:04,620 --> 00:03:01,750
grey water in the nutrient solution and

61
00:03:06,440 --> 00:03:04,630
then recover essentially potable

62
00:03:09,450 --> 00:03:06,450
drinking water

63
00:03:11,430 --> 00:03:09,460

recycling in space enlisting the

64
00:03:14,160 --> 00:03:11,440
expertise of scientists and engineers