HI.

I'M TRENT SMITH, THE VEGGI E PROJECT MANAGER AT KENNEDY SPACE CENTER.

TODAY WE HARVESTED OUR GROUND PLANTS AND WE'RE GOING TO TALK ABOUT THAT A LITTLE BIT AND MAYBE HAVE A LITTLE SURPRISE AT THE END.

WE HAVE SOME PANELISTS HERE TO TALK TO US ABOUT WHAT'S GOING ON AT NASA.

I HAVE OUR DEPUTY CENTER DIRECTOR, JANET PETRO.

TO MY FURTHER LEFT, I HAVE RONNY LAWSON.

HE'S OUR ASSISTANT DIRECTOR FOR THE INTERNATIONAL SPACE STATION HERE AT KENNEDY SPACE CENTER.
FURTHER DOWN THE ROW, WE HAVE LISA COLLOREDO.

SHE'S OUR ASSOCIATE MANAGER FOR THE COMMERCIAL CREW PROGRAM.

AND AT THE END, BATTING LAST, WE HAVE DR. GIOIA MASSA, OUR VEGGIE LEAD SCIENTIST.

[APPLAUSE]

>> THANK YOU.

I'D LIKE TO ASK JANET TO TAKE A COUPLE MINUTES AND TALK TO US ABOUT WHAT'S GOING ON HERE AT KENNEDY SPACE CENTER.

>> THANKS A LOT, TRENT.

AND I REALLY WANT TO THANK YOU FOR INVITING ME TO PARTICIPATE IN THIS EVENT TODAY.

SOMETHING YOU MAY NOT KNOW ABOUT ME IS ONE OF MY FAVORITE HOBBIES OR THINGS TO DO IS COOKING.
I'M VERY PASSIONATE ABOUT COOKING, SO I'M REALLY PLEASED TO BE HERE AND TO BE ABLE TO HOPEFULLY TASTE SOME OF THIS STUFF YOU HAVE GROWING OVER THERE.

I'M ALSO GLAD THAT IT'S NOT POTATOES.

FOR SOME OF YOU WHO HAVE READ THE MARTIAN AND THE WHOLE POTATO THING, I'M GLAD IT'S SOMETHING ABOUT LETTUCE BECAUSE I LIKE THAT A LOT MORE.

SO LET'S TALK A LITTLE BIT ABOUT NASA.

IT HAS A HUGE HERITAGE AND LEGACY OF INNOVATION AND I PERSONALLY THINK THAT'S ONE OF THE REASONS THAT WE'VE BEEN THE NUMBER ONE BEST PLACES TO WORK FOR THREE YEARS IN A ROW IS BECAUSE WE HAVE A CULTURE OF INNOVATION WITHIN OUR WORK.
FORCE.

I THINK IT STARTS ALL THE WAY FROM CHARLIE BOLDEN WHO HAS PUT OUT A LOT OF MEMOS AND IN ALMOST EVERY TALK HE GIVES, HE TALKS ABOUT INNOVATION IN OUR WORK FORCE AND ENCOURAGES US AND CHALLENGES US ALL THE WAY DOWN TO EACH INDIVIDUAL EMPLOYEE AND TO BE INNOVATIVE AND ADD VALUE TO WHAT WE DO EVERY DAY FOR OUR MISSION.

I DON'T KNOW IF YOU SAW DR. DAVA NEWMAN.

LAST WEEK SHE HELD A SESSION WITH A GROUP OF EMPLOYEES AND CHALLENGED THEM TO TALK ABOUT WHAT ARE ADDITIONAL THINGS THEY COULD DO WITH INNOVATION.
I KNOW LISA ROWE, ANOTHER ONE OF OUR SENIOR LEADERS AT THE AGENCY LEVEL THIS PAST WEEK TALKED WITH A GROUP OF DEPUTY CHIEF TECHNOLOGISTS AND ASKED THEM WHAT WE CAN DO AS AN AGENCY TO BE MORE FORWARD LEANING AND CHALLENGE OURS TO ADD MORE VALUE SO VEGGIE-- I'M NOT GOING TO TALK VERY MUCH ABOUT VEGGIE BECAUSE I KNOW THERE ARE PEOPLE FAR MORE KNOWLEDGEABLE ABOUT THIS PARTICULAR PROJECT, AND YOU'RE GOING TO HEAR MORE ABOUT IT FROM THEM. WHAT I WANTED TO SAY WAS VEGGIE WAS A LOW COST GROWTH CHAMBER AND IF YOU WATCHED THE NEWS YESTERDAY WE KNOW THEY HARVESTED IT ON THE INTERNATIONAL SPACE STATION.
THE INTERNATIONAL SPACE STATION IS A GREAT RESEARCH PLATFORM

THAT WE HAVE FOR US THAT'S IN LOWER EARTH ORBIT AND WE'RE LEARNING HOW TO LIVE AND WORK IN THAT LOWER EARTH ORBIT SO THAT WE CAN GO BEYOND THAT INTO THE PROVING GROUND AND THEN ONTO MARS AND OUR JOURNEY TO MARS.

WHAT I THINK IS MOST IMPORTANT ABOUT THAT IS HARVESTING THOSE VEGETABLES, WE ARE STILL ON THE INTERNATIONAL SPACE STATION RELIANT ON THE EARTH, BUT AS WE MOVE OUT TO MARS, WE'RE GOING TO HAVE TO LEARN HOW TO BE EARTH INDEPENDENT.

SO I THINK THIS IS A GREAT STEP ON THE SPACE STATION THAT DEMONSTRATES HOW, THROUGH INNOVATION AND TECHNOLOGY, WE
CAN LEARN TO BE LESS EARTH RELIANT SO WE CAN PROPEL OURSELVES ON THE JOURNEY TO MARS MUCH, MUCH, MUCH QUICKER.

AND THEN FINALLY I JUST WANTED TO PUT IN A PLUG FOR WHAT WE'RE DOING HERE AT KENNEDY SPACE CENTER.

I THINK MOST OF YOU-- HOPEFULLY MOST OF YOU HAVE HEARD OF OUR INNOVATION EXPO THAT'S COMING UP IN OCTOBER.

THIS IS AN ANNUAL EVENT AND EVERY YEAR IT'S GOTTEN BETTER AND BETTER.

IT'S HOSTED, EXECUTED AND MANAGED BY A GROUP CALLED THE SPACEPORT INNOVATORS THAT ARE A SELF-FORMED, SELF-MANAGED GROUP.

EVERY YEAR THEY'VE DONE A REALLY TREMENDOUS JOB OF DOING DIFFERENT THINGS ON IT.
THIS YEAR I KNOW THEY'RE INTENDING TO ENGAGE THE PUBLIC THROUGH THE VISITOR'S CENTER AT THE SAME TIME THAT WE'RE HOLDING THE INNOVATION EXPO HERE ON CENTER.

SO I WANT TO ENCOURAGE EVERYBODY TO PLEASE ATTEND THAT.

ONE OF THE GREAT THINGS THEY DO THERE IS THEY HAVE A KICK STARTING CAMPAIGN SO ALWAYS LOOKING FOR INNOVATIVE IDEAS FROM EMPLOYEES TO COME.

YOU PITCH YOUR IDEA TO THE GROUP AND IF YOU WIN THROUGH THIS KICK STARTING CHALLENGE, YOU GET A LITTLE BIT OF MONEY TO GO OFF AND DO SOMETHING INNOVATIVE THAT WILL HELP ADD VALUE TO WHAT WE'RE DOING OUT HERE AT KENNEDY.

THANK YOU.
I LOOK FORWARD TO YOUR QUESTIONS.

>> AWESOME.

THANK YOU, JANET.

APPRECIATE IT.

NEXT WE HAVE RONNY LAWSON WHO'S GOING TO TALK A LITTLE BIT ABOUT

THE SPACE STATION AND WHAT WE'RE DOING NINE TIMES FASTER THAN A BULLET.

>> GOOD MORNING.

GLAD YOU ALL CAME OUT.

JUST TO FOLLOW UP ON WHAT JANET SAID, THERE'S SOMETHING YOU MAY NOT KNOW ABOUT ME.

COOKING IS NOT MY BIG DEAL, BUT I LIKE TO EAT.

THAT'S A WELL KEPT SECRET.
00:05:43,870 --> 00:05:48,149
SINCE 1998 MYSELF AND A LOT OF
OTHER FOLKS OVER IN THE STATION

110
00:05:48,149 --> 00:05:52,459
PROGRAM, WE'VE BEEN ALL ABOUT
THE CONSTRUCTION AND THE

111
00:05:52,459 --> 00:05:55,370
MAINTENANCE AND KEEPING THE
SPACE STATION ON ORBIT AND

112
00:05:55,370 --> 00:05:56,370
FLYING.

113
00:05:56,370 --> 00:06:00,230
IT'S BEEN A REALLY BIG PART OF
SOME OF OUR CAREERS.

114
00:06:00,230 --> 00:06:03,490
SOMETIMES YOU GET SO BUSY DOING
WHAT YOU'RE DOING TO ASK THE

115
00:06:03,490 --> 00:06:06,240
QUESTION WHY ARE YOU DOING WHAT
YOU'RE DOING.

116
00:06:06,240 --> 00:06:10,269
WHAT WE SAW YESTERDAY WITH
VEGGIE, THAT'S WHY WE DID WHAT

117
00:06:10,269 --> 00:06:13,930
WE DID AND WHY WE'RE DOING WHAT
WE'RE DOING WITH SPACE STATION.

118
00:06:13,930 --> 00:06:18,360
STATION WAS DESIGNED AS A WORLD
CLASS LABORATORY FOR EXPLORATION

119
00:06:18,360 --> 00:06:22,370
AND BETTERMENT OF LIFE HERE ON
EARTH.

120
00:06:22,370 --> 00:06:24,680
THINGS THAT WE'RE LEARNING
THROUGH VEGGIE OR DEMONSTRATING
THROUGH VEGGIE ARE GOING TO BE COMPLETELY APPLICABLE NOT ONLY FOR EXPLORATION AS WE GO FORWARD BUT ALSO HERE ON EARTH.

GIOIA HAS SPOKEN TO ME A LITTLE BIT ABOUT SOMETHING CALLED VERTICAL FARMING WHICH I HAD NO IDEA ABOUT.

IT'S HOW MUCH SOME OF THE SAME CHALLENGES WE HAVE ON STATION FOR PLANT PRODUCTION AND GROWING FOOD, URBAN AREAS HAVE AS FAR AS SPACE AND THE ABILITY TO GROW FOOD.

VEGGIE REALLY IS A GOOD TEST BED FOR USING THIS KIND OF TECHNOLOGY IN THE FUTURE AS WE GO FARThER OUT INTO THE UNIVERSE.

BUT ALSO WHAT CAN WE DO HERE ON EARTH.

THE FOOD THAT THEY GET FROM VEGGIE IS NOT GOING TO FEED THE
CREW.

THERE'S NOT THAT KIND OF VOLUME THAT WE'RE GOING TO BE GROWING,

BUT IT DOES PROVIDE SOME GOOD, NUTRITIOUS FOOD THAT SHAKES

THEIR DIET UP A LITTLE BIT RATHER THAN THE STUFF THEY EAT

EVERY DAY.

THEY GET REALLY A GOOD PHYSIOLOGICAL AND PSYCHOLOGICAL

BOOST FROM THE ACT OF GARDENING AND JUST THE AESTHETICS OF

SEEING SOMETHING GROW IN THAT STERILE ENVIRONMENT ON THE

STATION.

VEGGIE HAS REALLY BEEN A GREAT THING THERE.

WE'RE DOING A TON OF OTHER STUFF THAT'S NEAR TERM AND FURTHER OUT

THAT'S IN THAT SAME VANE OF EXPLORATION LIKE VEGGIE.
FOR INSTANCE, WE'RE DEVELOPING ANOTHER PLANT HABITAT RIGHT NOW,

THE ADVANCE PLANT HABITAT WHICH AGAIN IS GOING TO BE USED FOR CROP SI ZED PLANTS LIKE VEGGIE DOES, BUT IT'S GOING TO BE ABLE TO CONTROL A LOT OF THE VARIABLES THAT AFFECT PLANT GROWTH LIKE HUMIDITY, TEMPERATURE, CARBON DIOXIDE, AND LIGHTING AND ALL OF THAT.

WHERE VEGGIE IS A GOOD PLATFORM FOR GROWING PLANTS, APH IS GOING TO BE A GOOD PLANT FORM OR TAKING THOSE VARIABLES AND UNDERSTANDING EXACTLY WHAT SPACE-GROWN PLANTS GO THROUGH BEING IN ZERO G AND A COMBINED SPACE.

THAT'S EXCITING TO US AND THAT WILL BE READY NEXT YEAR TO GET READY TO FLY TO STATION.
ALSO IN OUR SHOP WE ARE NOW DOING A TON OF OTHER TYPE OF PROJECTS GOING ON RIGHT NOW THAT ARE IN THIS SAME EXPLORATION VANE.

WE'RE STUDYING THINGS LIKE BEING ABLE TO GO AND BUILD STRUCTURES ON AN OUTPOST OR MINING GASES AND EVEN ROCKET FUEL FROM REGALA.

THEY'RE ALL GOING TO BE IMPORTANT STEPPING STONES ALONG THE WAY IF WE'RE GOING TO MARS.

VEGGIE IS A GOOD FIRST STEP AND I'M EXCITED TO WORK WITH THE TEAM THAT PULLED THIS WORK.

THANKS, RONNY.

APPRECIATE IT.

LISA IS GOING TO TALK TO US
ABOUT THE COMMERCIAL CREW

00:09:01,490 --> 00:09:04,990
PROGRAM AND A LITTLE ABOUT
COMMERCIAL SPACE.

00:09:04,990 --> 00:09:06,039
LISA?

00:09:06,039 --> 00:09:08,139
>> THANKS, TRENT.

00:09:08,139 --> 00:09:11,299
SOMETIMES PEOPLE WONDER WHY IS
COMMERCIAL CREW SITTING HERE

00:09:11,299 --> 00:09:16,028
WITH THE STATION PROJECT GOING
ON AND THE VEGGIE PROJECT.

00:09:16,028 --> 00:09:20,730
REALLY THE COMMERCIAL CREW
PROGRAM IS REALLY HAND IN HAND

00:09:20,730 --> 00:09:25,778
CONNECTED WITH THE ISS AND ALSO
THE AGENCY’S OVERALL PATH TO GET

00:09:25,778 --> 00:09:27,289
TO MARS.

00:09:27,289 --> 00:09:32,490
HAVING A COMMERCIALMALLY AVAILABLE
VEHICLE THAT WILL TAKE CREW TO

00:09:32,490 --> 00:09:36,149
AND FROM STATION IS REALLY,
REALLY CRITICAL TO BETTER

00:09:36,149 --> 00:09:40,919
UNDERSTANDING THE CAPABILITIES
THAT WE NEED TO DEVELOP ON THE

00:09:40,919 --> 00:09:44,808
INTERNATIONAL SPACE STATION
LABORATORY AND ALSO THE LONG

181
00:09:44,808 --> 00:09:49,110
DURATION MISSIONS THAT ARE
COMING UP TO GET TO MARS IN A

182
00:09:49,110 --> 00:09:51,308
COUPLE OF REALLY IMPORTANT WAYS.

183
00:09:51,308 --> 00:09:56,328
ONE IS WE'RE GOING TO BE-- OUR
REQUIREMENT IS TO HAVE FOUR CREW

184
00:09:56,328 --> 00:10:00,528
ON OUR COMMERCIAL VEHICLE, SO
THIS IS ONE CREW MORE THAN WE

185
00:10:00,528 --> 00:10:06,519
CURRENTLY HAVE AVAILABLE ON THE
SOYUZ MISSIONS, SO THAT CREW AND

186
00:10:06,519 --> 00:10:11,049
THE TIME THAT THEY CAN SPEND ON
STATION TO DO SCIENCE IS LIKE

187
00:10:11,049 --> 00:10:12,088
GOLD.

188
00:10:12,089 --> 00:10:17,459
THEY HAVE A VERY LIMITED TIME,
AND THE EXTRA CREW WILL EQUATE

189
00:10:17,458 --> 00:10:21,078
TO ABOUT 40 HOURS OF RESEARCH
AND SCIENCE THAT THEY COULD TAKE

190
00:10:21,078 --> 00:10:26,138
ADVANTAGE OF TO DO PROJECTS LIKE
VEGGIE AND OTHER INNOVATIVE

191
00:10:26,139 --> 00:10:29,999
PROJECTS THAT ARE YET TO BE
COMING OUR WAY.

192
00:10:29,999 --> 00:10:32,058
ALL OF THOSE WILL HELP IN THE PATH.

WE'RE JUST ONE PIECE OF THE BIG PUZZLE TO GET THE AGENCY TO GET TO MARS.

WE ARE WORKING DAILY WITH OUR COMMERCIAL PARTNERS.

WE HAVE BOEING, CST-100 IS IN DEVELOPMENT AS WE SPEAK AND THE SPACE-EX CREW DRAGON.

AGAIN, WE'LL HAVE THE CAPABILITY TO HAVE FOUR, BUT TYPICAL WITH INDUSTRY, IT OPENS UP A LOT OF OPPORTUNITY FOR OTHER KIND OF INNOVATION.

ALTHOUGH OUR COMMERCIAL PROVIDERS ARE REQUIRED TO HAVE FOUR CREW, THEY HAVE CAPABILITIES THAT WILL INCLUDE MORE THAN FOUR CREW.

IT COULD BE FOR OTHER PAYLOADS.
AND CARGO ON SCIENCE THAT COULD

00:11:19,208 --> 00:11:20,208
GO UP.

00:11:20,208 --> 00:11:23,338
IT COULD BE SOME EXPERIMENTS
THAT YOU ALL OR MAYBE YOUR KIDS

00:11:23,339 --> 00:11:26,930
OR SOMEBODY ELSE WILL BE
PROVIDING IN THE FUTURE.

00:11:26,929 --> 00:11:31,379
AGAIN, IT'S ALL THIS PATH FOR
THE AGENCY THE TO GET EXPERIENCE

00:11:31,379 --> 00:11:36,549
THE PROVEN GROUND TO GO FROM
WHAT WE KNOW NOW AND WHAT WE

00:11:36,549 --> 00:11:40,549
NEED TO KNOW TO SUSTAIN LONG
DURATION HUMAN SPACE FLIGHT TO

00:11:40,549 --> 00:11:41,549
GET TO MARS.

00:11:41,549 --> 00:11:44,939
IT'S GOING TO BE A BIG CHALLENGE
FOR THE AGENCY.

00:11:44,940 --> 00:11:48,429
IT'S A COUPLE OF YEAR MISSION.

00:11:48,428 --> 00:11:57,568
THIS IS ONE STEP TOWARDS THAT
JOURNEY TO MARS.

00:11:57,568 --> 00:12:03,769
>> AS A PAYLOAD MANAGER WE LOOK
FORWARD TO THE EXTRA CREW TIME.

00:12:03,769 --> 00:12:06,940
LASTLY, CERTAINLY NOT LEAST, WE
GIOIA MASSA WHO’S GOING TO TALK TO US A LITTLE ABOUT VEGGIE AND PLANTS IN SPACE AND THE FUTURE OF PLANTS IN SPACE.

GIOIA, TAKE IT AWAY.

I'M HONORED TO BE UP HERE REPRESENTING THE VEGGIE TEAM AND I'M SO HAPPY TO SEE A GREAT PORTION OF THAT TEAM HERE.

CONGRATULATIONS TO EVERYONE.

VEGGIE REALLY IS ALL ABOUT TEAM WORK.

THE MORE INVOLVED I’VE GOTTEN, THE MORE I’VE SEEN THAT SCIENCE IS JUST A VERY SMALL PART OF EVERYTHING THAT IT TAKES TO DO RESEARCH IN SPACE, TO DO FOOD PRODUCTION IN SPACE.

WE ARE RESEARCH BUT WE'RE ALSO
MAKING SOMETHING TO EAT.

WE HAVE A WONDERFUL TEAM.

THE CORE OF THE TEAM IS KENNEDY HERE.

WE'VE REALLY EMBRACED THE PLANT RESEARCH HERE, AND THIS IS KIND OF SPRUNG OUT OF THIS GROUP.

BUT WE ALSO HAVE TEAM MEMBERS AT JOHNSON SPACE FLIGHT CENTER,

MARSHAL SPACE FLIGHT CENTER, EVEN GLEN RESEARCH CENTER, AND

OF COURSE THE FOLKS AT HEADQUARTERS WHO HAVE REALLY ENABLED THIS TO GO ON.

THE ASTRONAUTS WHO ARE OUR INSPIRATION, OUR EXCITEMENT, WE CAN'T THANK THEM ENOUGH FOR ALL THEIR HARD WORK ON THIS.

THIS IS BUILDING ON DECADES OF PLANT RESEARCH, OF RESEARCH IN PLANTED SPACE BIOLOGY,
BIOREGENERATIVE LIFE SUPPORT

241
00:13:30,778 --> 00:13:33,178
SYSTEMS AND CONTROLLED
ENVIRONMENT AGRICULTURE THAT'S

242
00:13:33,178 --> 00:13:37,928
GONE ON AT NASA, AT
UNIVERSITIES, AND AT RESEARCH

243
00:13:37,928 --> 00:13:39,928
CENTERS AROUND THE WORLD.

244
00:13:39,928 --> 00:13:44,269
SO WE'RE BUILDING ON THIS REALLY
STRONG FOUNDATION OF KNOWLEDGE,

245
00:13:44,269 --> 00:13:48,620
AND WE HAVE A PUBLIC/PRIVATE
PARTNERSHIP THAT'S BEEN KEY.

246
00:13:48,620 --> 00:13:50,269
ACTUALLY SEVERAL.

247
00:13:50,269 --> 00:13:53,629
THE FIRST AND FOREMOST IS ORBIT
TECH WHICH DESIGNED AND BUILT

248
00:13:53,629 --> 00:14:05,269
THE VEGGIE HARDWARE THROUGH THE
NASA SMALL BUSINESS INNOVATIVE

249
00:14:05,269 --> 00:14:08,639
RESEARCH PROGRAM AND CONTINUED
TO WORK WITH US THROUGH

250
00:14:08,639 --> 00:14:05,519
DIFFERENT ITERATIONS OF VEGGIE
UNTIL WE GOT TO FLIGHT.

251
00:14:05,519 --> 00:14:08,639
IN ADDITION, WE'VE HAD OTHER
COMPANIES THAT HAVE BEEN

252
00:14:08,639 --> 00:14:13,769
INVOLVED THAT HAVE PROVIDED
TECHNICAL EXPERTISE AND RESEARCH

00:14:13,769 --> 00:14:16,818
AND SUPPORT FOR THIS PROJECT AND
WE REALLY CAN'T THANK THEM

00:14:16,818 --> 00:14:17,818
ENOUGH.

00:14:17,818 --> 00:14:23,088
WE'VE HAD EDUCATORS AND FELLOWS
AND STUDENTS AND INTERNS

00:14:23,089 --> 00:14:26,329
INVOLVED IN THIS AND WE'RE
ACTUALLY JUST BEGINNING A NEW

00:14:26,328 --> 00:14:31,419
EDUCATION PROGRAM WITH FAIRCHILD
TROPIC BOTANIC GARDENS IN SOUTH

00:14:31,419 --> 00:14:33,938
FLORIDA WHERE THEY'RE GOING TO
ENGAGE HUNDREDS OF SCHOOL

00:14:33,938 --> 00:14:37,599
CHILDREN TO HELP US SELECT THE
NEXT CROPS THAT MAY BE GROWN IN

00:14:37,600 --> 00:14:38,600
VEGGIE.

00:14:38,600 --> 00:14:43,239
WE'RE REALLY EXCITED ABOUT THAT
AND ALL THE POTENTIAL FOR

00:14:43,239 --> 00:14:45,040
VEGGIE.

00:14:45,039 --> 00:14:48,879
WE'VE BEEN FORTUNATE BECAUSE
VEGGIE HAS SHOWN US THAT WE CAN

00:14:48,879 --> 00:14:52,980
GROW PLANTS IN SPACE SIMILARLY TO HOW WE'RE GROWING THEM HERE.

ON EARTH.

THAT'S GREAT BECAUSE IT OPENS UP A LOT OF POTENTIAL FOR NEW RESEARCH THAT WE CAN BE DOING HERE, TESTING AND THEN FLYING UP THERE.

IT ALSO GIVES US A LOT OF CONFIDENCE THAT WE CAN GROW FOOD.

IN VEGGIE AND IN VEGGIE FOLLOW-ONS TO FEED THE CREW AND TO DO IT SAFELY.

IT'S BEEN A WONDERFUL EXPERIENCE FOR ME AND I THINK I CAN SPEAK ON BEHALF OF THE TEAM THAT FOR ALL OF US WE'VE REALLY ENJOYED IT.

I THINK THE APPEAL OF VEGGIE IS, AS SOME OF MY FELLOW SPEAKERS HAVE SAID, WE ENGAGE NOT JUST
THE GARDENERS BUT THE PEOPLE WHO
LIKE TO COOK AND THE PEOPLE WHO
LIKE TO EAT AND THAT'S A PRETTY

BIG PERCENTAGE OF THE
POPULATION.

I THINK WE WERE ALL A LITTLE
SURPRISED AT HOW ENGAGING IT WAS

FOR THE GENERAL PUBLIC, BUT
THAT'S JUST WONDERFUL.

I THINK VEGGIE IS REALLY FROM
THE EARTH, OF THE EARTH, FOR THE
earth and for the future.

AS ONE OF MY FAVORITE QUOTES
FROM YESTERDAY'S MEDIA FEEDING

FRENZY IS, IT'S A REALLY
INSPIRING SALAD.

IT'S A MOMENTOUS SALAD.

I THINK WITH THAT, WE WILL GO TO
THE VIDEO OF THE CREW

HARVESTING.

>> WE'RE STANDING BY NOW FOR THE
FIRST CONSUMPTION OF ONE OF

289 00:16:29,220 --> 00:16:32,589
THESE RED ROMAINE LETTUCE LEAVES
THAT HAS BEEN GROWN IN THE

290 00:16:32,589 --> 00:16:35,470
MICROGRAVITY OF SPACE.

291 00:16:35,470 --> 00:16:42,379
>> THIS IS AN ASTRONAUT
HARVESTING HALF THE LEAVES FOR

292 00:16:42,379 --> 00:16:45,170
THE CONSUMPTION HARVEST, AND
THEN THE OTHER HALF ARE GOING TO

293 00:16:45,169 --> 00:16:49,539
BE RETURNED HERE FOR SCIENCE
ANALYSIS.

294 00:16:49,539 --> 00:16:52,828
THE FIRST SET OF PLANTS WHICH
WERE GROWN LAST YEAR WERE

295 00:16:52,828 --> 00:16:56,828
RETURNED FOR SCIENTIFIC ANALYSIS
AND THAT REALLY ENABLED US TO

296 00:16:56,828 --> 00:17:00,219
HAVE THE CREW BE ABLE TO EAT THE
PLANTS THIS TIME.

297 00:17:00,220 --> 00:17:04,990
WITH THAT, WE'RE GOING TO DO
SOME HARVESTING OF OUR OWN.

298 00:17:04,990 --> 00:17:09,419
THIS PLANT HERE IS ACTUALLY NOT
THE RED ROMAINE LETTUCE.

299 00:17:09,419 --> 00:17:16,220
THIS IS CHINESE CABBAGE WHICH
WE'LL FLY UP AGAIN.
WE ARE GOING TO HARVEST SOME OF THESE LEAVES.

GET MY GLOVES.

WE'RE TRYING TO TAKE CARE OF THE PLANT IN A VERY CLEAN WAY AND SO THAT'S WHY THE ASTRONAUTS GENERALLY WERE WEARING GLOVES WHEN THEY HANDLED THE PLANTS.

ESPECIALLY ON SPACE STATION WHERE IT'S PRETTY TRICKY TO CLEAN YOUR PRODUCE.

WE'RE GOING TO USE GRAVITY TO WORK ON OUR BEHALF HOWEVER, SO WE DON'T HAVE TO WORRY ABOUT LEAVES FLOATING AWAY LIKE THEY DID.

>> YESTERDAY, KJELL LINDGREN, WHEN HE HARVESTED THE LETTUCE, HE SET DOWN A LEAF AND IT STARTED FLOATING AWAY.
SCOTT KELLY CAME IN AND HELPED OUT.

00:18:02,288 --> 00:18:12,658
>> I THINK HE WAS HOPING THERE WAS VELCRO ON THE BACK OF IT BUT

00:18:12,659 --> 00:18:15,179
WE DIDN'T HAVE ANY VELCRO.

00:18:15,179 --> 00:18:16,690
>> SALAD
>> WELL TRAVELED.

00:18:16,690 --> 00:18:20,041
>> ABOUT A MONTH AGO I TOOK SALAD UP TO DAY ON THE HILL, SO

00:18:20,040 --> 00:18:24,579
SALAD IS KIND OF OUR AMBASSADOR FOR VEGGIE 03.

00:18:24,579 --> 00:18:27,699
SHE WAS IN MANY PHOTOGRAPHS WITH A COUPLE ASTRONAUTS WHO WERE

00:18:27,700 --> 00:18:29,990
THERE, REED WISEMAN AND BUTCH WILL MORE.

00:18:29,990 --> 00:18:33,048
CHARLIE BOLDEN HELD HER AND WE TALKED ABOUT THE ASTRONAUTS

00:18:33,048 --> 00:18:37,250
EATING AND THE MEMBERS OF CONGRESS AND THE STAFFERS WHO

00:18:37,250 --> 00:18:41,450
MAKE THE LAWS WERE ALL VERY EXCITED TO MEET SALAD.

00:18:41,450 --> 00:18:44,880
THAT'S HER NAME BY THE WAY, SALAD.
WE ARE GOING TO GET SEEDS JUST LIKE SALAD FLOWN UP ON THE NEXT SPACE EX MISSION.

WE'RE TARGETING SPACE-EX 8.

WE'LL SEE WHEN THAT FLIES.

WE'LL SEE IF WE MAKE THAT.

WE'LL GET IT ON SPACE-EX 8 OR 9 AND WE'LL HAVE THOSE POSITIONED AND THE ASTRONAUTS WILL BE ABLE TO GROW THOSE WHEN THEY'RE READY.

THE NEXT CROP ON SPACE STATION, AT LEAST THAT'S EDIBLE, WILL BE CABBAGE.

>> THESE DWARF TOMATO PLANTS ARE PLANTS WE'RE HOPING TO FLY IN A COUPLE OF YEARS AS WELL.

WE'VE BEEN DOING A LOT OF RESEARCH HERE ON WHAT OTHER
CROPS WE MIGHT GROW IN VEGGIE AND DWARF TOMATOES ARE AN EXCELLENT CANDIDATE.

RIGHT NOW I'M GOING TO SANITIZE THE CABBAGE LEAVES USING SOME WIPES, THE SAME WAY THAT THE CREW DID ON ORBIT.

WHILE I'M DOING THAT, I THINK WE CAN PLAY THE NEXT VIDEO WHICH SHOWS THE CREW ENJOYING THE FRUITS OF THEIR LABOR.

>> WHOO HOO!

>> CHEERS!

>> THAT’S AWESOME.

>> TASTES GOOD.

>> YEAH.

>> KIND OF LIKE ARUGULA.

>> IT’S FRESH.
>> SOME OIL AND VINEGAR.

>> THAT'S GOOD.

>> THAT LOOKS COOL.

>> ALL RIGHT, SO GIOIA IS JUST NOW GETTING THE CABBAGE LEAVES IN BETWEEN THE PRO SAN WIPES AND THAT'S A CITRIC ACID-BASED SOLUTION THAT OUR TEAM AT KENNEDY MADE UP.

WE HAVE TEN WIPES PER BAG.

THIS IS ONE THAT WE USED FOR OUR GROUND CONTROL EARLIER.

THEY PUT IT IN BETWEEN THE WIPES TO MAKE GOOD CONTACT AND SHE'S GOING TO COMPRESS IT FOR LIGHTLY DOING IT BECAUSE YOU WANT TO MAKE SURE IT MAKES GOOD CONTACT.
THEN IT SHOULD BE GOOD TO EAT.

WHEN WE DID THE ANALYSIS, THE PLANTS THAT WE LOOKED AT AND TESTED CAME BACK AS CLEAN IF NOT CLEANER THAN THOSE THAT YOU WOULD BUY IN A GROCERY STORE.

THIS IS REALLY JUST A PRECAUTIONARY STEP THAT WE DO,

JUST LIKE YOU DO AT HOME.

YOU WASH YOUR PLANTS BEFORE YOU EAT THEM TYPICALLY.

MOST OF YOU PROBABLY DO.

THAT'S WHAT WE'RE DOING, AND THEN WE DO HAVE SOME OIL, SOME EXTRA VIRGIN OLIVE OIL, BALSAMIC VINEGAR, AND WE'RE GOING TO TASTE THE FRUITS OF OUR VEGGIE TEAM'S LABOR HERE SOON.

AND IN ADDITION TO THAT, WE'RE GOING TO TEST OUT THE VEGGIE 03
CROP AND WE'LL SEE MAYBE A COMPARATIVE DIFFERENCE.

I THINK THE CREW-- THIS IS MY PERSONAL OPINION BECAUSE I'VE TRIED BOTH-- I THINK THEY'RE GOING TO LIKE THE CABBAGE EVEN MORE.

I'LL LET YOU MAKE YOUR OWN JUDGMENT.

>> ARE WE GOING TO GET A BITE OF BOTH?

>> YOU ARE GOING TO GET A BITE OF BOTH.

THEN WE'RE GOING TO CALL UP A COUPLE OF OUR AUDIENCE MEMBERS AND LET THEM TASTE FOR THEMSELVES.

I HOPE YOU'RE HUNGRY.

>> I WAS TALKING TO RONNY AND SAID, I CAN'T IMAGINE HOW GOOD FRESH LETTUCE IS UP THERE.
I CRAVE THAT.

00:23:04:579 --> 00:23:06:609
SOMETIMES YOU JUST REALLY WANT
SOMETHING.

00:23:06:609 --> 00:23:10:569
HE SAID THAT HE'LL BE REALLY
IMPRESSED WHEN THEY START

00:23:10:569 --> 00:23:16:878
GRILLING STEAKS UP THERE.

00:23:16:878 --> 00:23:22:519
>> IF YOU WANT TO SQUIRT A
LITTLE OIL AND VINEGAR-- THIS

00:23:22:519 --> 00:23:25:200
IS MY FINE COMPLIMENTS FROM
HOME.

00:23:25:200 --> 00:23:29:110
I GOT YOUNG KIDS, SO THIS IS
WHAT WE USE.

00:23:29:109 --> 00:23:34:919
>> I DO HAVE A QUESTION.

00:23:34:920 --> 00:23:38:329
WAS THERE ANY DIFFERENCE BETWEEN
THE LETTUCE GROWN UP THERE AND

00:23:38:328 --> 00:23:43:259
THE LETTUCE GROWN ON THE GROUND?

00:23:43:259 --> 00:23:47:089
FROM A FOOD SAFETY
STANDPOINT, EVERYTHING WAS GOOD.

00:23:47:089 --> 00:23:51:048
OUR TEAM HERE ACTUALLY DID A
MINERAL COMPOSITION.
WHAT MAKES IT RED IS ANTHOCYANIN WHICH IS AN ANTIOXIDANT.
EVERYTHING WAS PRETTY MUCH THE SAME.
WE HAD THREE PLANTS LAST YEAR.
WE HAD FIVE GROUND PLANTS.
FOR THE NUMBER, IT WAS HARD TO KNOW.
GO AHEAD AND DIG IN.
THIS IS THE ONE TIME YOU DON'T NEED PERMISSION.
GIVE IT A TRY.
YOU'RE NOT GOING TO HAVE ANY OIL?
I'M GOING TO TRY IT BOTH BEFORE AND AFTER.
BALSAMIC VINEGAR, YUM.
THEY MADE A VERY BIG POINT OF TALKING ABOUT THE BALSAMIC
VINEGAR AND THE OLIVE OIL.

VERY CUTE.

>> VERY DIFFERENT, VERY DIFFERENT.

DELICIOUS.

>> COME ON UP AND GRAB SOME PRODUCE.

>> THIS IS WAY BETTER THAN WHAT I WOULD GROW IN MY GARDEN.

>> PART OF OUR VEGGIE TEAM, MARY ACTUALLY IS A MICROBIOLOGIST AND MICHELLE IS A CHEMIST.

SO WHEN I SAY THE VEGGIE TEAM DID AN ANALYSIS, HERE'S PART OF THE VEGGIE TEAM THAT DID IT, SO THANK YOU.

HOW ABOUT EVERYBODY THAT'S ON VEGGIE AND WORKED VEGGIE, RAISE THEIR HAND.

LOOK AT THAT.
>> GIOIA, WHEN YOU GET A MOMENT, PAPER TOWELS?

>> THANK YOU, YOU ALL DID GREAT.

>> WHY DID WE PICK THE LETTUCE THAT WE PICKED?

>> I MENTIONED THAT WE'RE STANDING ON A STRONG FOUNDATION.

SO THAT WAS ACTUALLY TESTED FOR A NUMBER OF YEARS HERE AT KENNEDY SPACE CENTER FOR ITS PRODUCTIVITY.

IT'S A VERY PRODUCTIVE SALAD CROP.

IT GROWS VERY WELL.

IT HAS VERY RELIABLE GERMINATION.

IT'S VERY ATTRACTIVE.
It has high levels of antioxidants which most red vegetables do.

It could be a potential counter measure against space radiation damage.

It also, as a lettuce, has very low natural microbial levels, so a lot of bacteria do not grow on the leaves.

And it tastes pretty good, too.

>> So you've tried it.

Lisa, which one did you like better? Just curious.

>> I think I like the cabbage better but they're both really good.

>> I think I like the cabbage better but they're both really good.

Ronny?
>> CABBAGE.

>> JANET?

>> I LIKED BOTH BUT I'M LEANING TOWARDS THE CABBAGE.

>> I THINK THIS IS REALLY TELLING.

THE CABBAGE-- AND I'LL LET GIOIA, AS SOON AS SHE GETS A

CHANGE TO STOP SERVING US ALL, TELL THE STORY.

PART OF THE HUMAN RESEARCH PROGRAM, THE TEAM HERE AT

KENNEDY SPACE CENTER, DR. RAY WHEELER AND GIOIA AND MICHELLE

AND MARY AND A NUMBER OF OTHERS HAVE STUDIED A NUMBER OF THESE

LEAFY GREENS, AND THE CABBAGE SCORED THE HIGHEST FOR ITS

FLAVOR.
SO THAT IS ONE OF THE DECIDING FACTORS WHY IT'S A PRIMARY PART OF VEGGIE 03 IS WE WANT THE ASTRONAUTS TO TASTE THE MOST FLAVORFUL LEAFY GREEN.

>> NUTRITIONALLY ARE THEY PRETTY CLOSE TO THE VALUES?

>> I WOULD DEFER TO THE DOCTOR ON THAT.

>> I'M GOING TO GET SOMETHING TO EAT.

NUTRITIONALLY, THE CABBAGE DID NOT SCORE AS HIGHLY AS SOME OF THE OTHER CROPS, BUT IT HAD THE HIGHEST RATINGS FROM A HORTICULTURAL POINT OF VIEW, SO IT WAS VERY EASY TO GROW, VERY VIGOROUS.

SO IT WAS ACTUALLY A GREAT PLANT TO GROW.

IT SCORED VERY HIGHLY THERE, AND FROM THE TASTE TEST, IT SCORED
INCREDIBLY HIGHLY.

SO WE GREW EIGHT DIFFERENT VARIETIES OF LEAFY GREENS,

INCLUDING OUTREACHES BUT WE HAD OTHERS THAT WE WERE HOPING WOULD BE A GOOD CANDIDATE.

WE HARVESTED A LARGE AMOUNT AND SENT THEM REFRIGERATED TO JOHNSON SPACE CENTER WHERE THEY HAVE THE ADVANCED FOOD TECHNOLOGY GROUP WHO ARE PART OF OUR LARGER VEGGIE TEAM AND THE LAB.

THAT'S WHERE THEY DO THE TASTE TESTS.

THEY DID A TASTE PANEL OF THE TOP FOUR GROWING VEGETABLES THAT HAD THE HIGHEST NUTRITION AND THE BEST GROWTH AND THE CHINESE CABBAGE SCORED MOST HIGHLY OF ALL OF THOSE.
WE WERE DELIGHTED AND THAT'S HOW WE'VE SELECTED IT FOR THE NEXT FLIGHT.

>> YOU ALSO SELECTED IT, SO I THINK THAT'S PRETTY COOL.

WHILE GIOIA GETS HER SNACK, LET'S OFFER ANYONE IN THE AUDIENCE HAVE A QUESTION?

I THOUGHT IT WAS THE GENTLEMAN BEHIND HER.

PLEASE, GO AHEAD.

>> I AM MENTORING A 10-YEAR-OLD NASA GIRL FROM WISCONSIN WHO ALSO LOVES TO COOK.

SO THIS QUESTION IS FOR HER.

SHE KNOWS THAT YOU'RE NOT SUPPOSED TO CUT LETTUCE, YOU
TEAR LETTUCE BECAUSE IT AFFECTS THE TASTE, AND SHE FELT THAT IT

498 00:29:06,669 --> 00:29:09,600
LOOKED LIKE THEY WERE DOING SURGERY ON THE LETTUCE, BETWEEN

499 00:29:09,599 --> 00:29:12,138
THE GLOVES AND THE SCISSORS AND EVERYTHING.

500 00:29:12,138 --> 00:29:17,138
SHE WANTED TO KNOW WHY THEY DIDN'T TEAR INTO IT.

501 00:29:17,138 --> 00:29:21,008
>> I'M GOING TO DEFER TO GIOIA, BUT PART OF THAT, TOO, IS

502 00:29:21,009 --> 00:29:23,700
BECAUSE WE DIDN'T WANT THEIR HANDS-- WE WANTED THEIR HANDS

503 00:29:23,700 --> 00:29:27,169
TO BE CLEAN WHEN THEY WERE CUTTING THE LETTUCE.

504 00:29:27,169 --> 00:29:30,190
I'LL DEFER TO GIOIA FOR THE CUTTING PART.

505 00:29:30,190 --> 00:29:35,240
>> ORIGINALLY WHEN WE DID THE HARVEST LAST YEAR, WE BROUGHT

506 00:29:35,240 --> 00:29:37,440
THE PLANTS BACK FROZEN.

507 00:29:37,440 --> 00:29:44,840
SO ONE OF THE THINGS WE SENT WAS A TOOL SET UP WHICH HAD SCISSORS

508 00:29:44,839 --> 00:29:54,209
AND FORCEPS BECAUSE WE WANTED TO SEE WHAT WERE THE NATIVE
MICROBIAL LEVELS ON THE PLANT SURFACE.

THE TOOLS WERE ALREADY THERE.

WE JUST ADAPTED THIS HARVEST PROCEDURE TO THAT.

THEY WEREN'T REALLY ALLOWED TO EAT THE ENTIRE PLANT THIS TIME.

WE WANTED TO STILL BRING BACK SOME OF THE PLANT FOR SCIENTIFIC EXPERIMENTATION.

SO WE JUST HAD THEM REMOVE SELECTED LEAVES.

BUT I THINK PART OF THE REASON ALSO IS BECAUSE KJELL IS A DOCTOR AND WE THOUGHT HE MIGHT BE A LITTLE MORE COMFORTABLE DOING SURGERY.

IT WAS MOSTLY JUST TO KEEP THINGS CLEAN.

THEY CLEANED THE TOOLS WITH THE SAME PRODUCE SANITIZING WIPES.
BEFORE AND AFTER USE.

GOOD QUESTION.

>> I SEE A VEGETABLE TEAM MEMBER BACK THERE.

CHUCK SPURN.

>> I UNDERSTAND FROM LOOKING AT THE PHOTOS THAT YOU PROVIDED EVERY DAY THAT THE PLANTS ON ORBIT GREW ACTUALLY BETTER THAN THE PLANTS IN OUR GROUND CONTROL.

I WONDER IF THERE'S ANY THEORIES AS TO WHY THAT IS IN THE VEGETABLE SYSTEM.

I HAVE A COUPLE THEORIES.

IT WAS ACTUALLY A LOT OF FUN LETTING THE CREW KNOW THAT THEY WERE WINNING.

WHEN WE DID START INJECTING
WATER DIRECTLY INTO THE PILLOWS,

00:31:09,819 --> 00:31:13,778
WHEN THE LITTLE PLANT IN PLANT B
POPPED A LEAF OUT ON SUNDAY, IT

00:31:13,778 --> 00:31:15,099
WAS A BIG SURPRISE.

00:31:15,099 --> 00:31:19,490
I HAD GIVEN UP ON THAT PLANT
ACTUALLY.

00:31:19,490 --> 00:31:21,849
SO WE STARTED WATERING THAT
PI LLOW AGAIN.

00:31:21,849 --> 00:31:26,878
THOSE PLANTS REALLY WERE AHEAD
OF OUR GROUND PLANTS AND I THINK

00:31:26,878 --> 00:31:31,980
PART OF THAT IS BECAUSE YOU HAVE
MORE EFFECTIVE WICKING OR

00:31:31,980 --> 00:31:34,690
MOISTURE WICKING IN SPACE
BECAUSE IT DOESN'T NEED TO FIGHT

00:31:34,690 --> 00:31:37,230
AGAINST GRAVITY.

00:31:37,230 --> 00:31:41,118
OUR GROUND PLANTS, IF WE PUT TOO
MUCH WATER INTO THE PLANT PILLOW

00:31:41,118 --> 00:31:44,500
FOR INSTANCE, IT WOULD DRIP
THROUGH ONE OF THE CORNERS.

00:31:44,500 --> 00:31:48,269
I BELIEVE I ONLY RECALL ONE
INSTANCE WHERE THEY ONLY ADDED A

00:31:48,269 --> 00:31:50,880
PARTICULAR AMOUNT OF WATER BECAUSE IT STARTED COMING OUT

ONE OF THE SEAMS.

I THINK IT BASICALLY HAS TO DO WITH PASSIVE WICKING AND THE LACK OF GRAVITY.

GIOIA, DO YOU HAVE ANYTHING?

>> I WOULD AGREE, WE GREW OUR GROUND CONTROL HERES IN CONTROLLED ENVIRONMENT CHAMBERS THAT WERE SET TO MIMIC THE SPACE.

SO WE TRIED TO ELIMINATE AS MANY VARIABLES AS WE CAN.

WE USED EXACTLY THE SAME FLIGHT HARDWARE FOR THE OPERATIONS.

SO GRAVITY HAS A LOT OF DIFFERENT IMPACTS ON THINGS, BUT FLUIDS AND GAS MOVEMENTS ARE
PROBABLY ONE OF THE MAIN ONES.

558
00:32:37,749 --> 00:32:41,990
I THINK WATERING YOUR PLANTS IN
SPACE AND WATERING THEM THE SAME

559
00:32:41,990 --> 00:32:46,370
ON THE GROUND IS ONE OF THE
BIGGEST CHALLENGES BECAUSE THE

560
00:32:46,369 --> 00:32:49,319
FLUIDS JUST BEHAVE SO VERY
DIFFERENTLY.

561
00:32:49,319 --> 00:33:03,329
I SORT OF LIKEN WATERING PLANTS
IN MICROGRAVITY TO BEING ON THAT

562
00:33:03,329 --> 00:33:08,628
KNIFE EDGE BETWEEN FLOODING AND
DROUGHT.

563
00:33:08,628 --> 00:33:15,209
DOWN HERE, WE AGAIN HAD GRAVITY
WORKING AGAINST US SO, YEAH, I

564
00:33:15,210 --> 00:33:17,909
THINK IT'S PROBABLY JUST WATER.

565
00:33:17,909 --> 00:33:21,320
>> I THINK THE ASTRONAUTS WON,
FOR SURE.
I’D LIKE TO KNOW IF THE PLANTS THAT YOU HAVE BOTH HERE AND UP AT THE STATION GROW AT THE SAME SPEED THAT THE TRADITIONAL PLANTS GROW.

CAN YOU SPEED UP THE PROCESS?

WHEN WE GROW PLANTS IN CONTROLLED ENVIRONMENTS LIKE VEGGIE, WE ARE SPEEDING UP QUITE A LOT OVER PLANTS GROWING OUTSIDE BECAUSE WE’VE ELIMINATED A LOT OF THE STRESS. STRESS IS REALLY WHAT SLOWS PLANTS DOWN.

WE DID STILL HAVE SOME WATER STRESS DURING THIS EXPERIMENT WHERE THEY DIDN’T GET ENOUGH WATER AND WE HAD THE CREW MANUALLY INTERVENE, SO THAT DID SLOW THEM DOWN FOR A COUPLE OF DAYS BUT THAT WAS PRETTY SIMILAR BETWEEN GROUND AND FLIGHT.
SO WE'RE STILL WORKING ON GETTING THAT HAPPY MEDIUM WITH THE WATERING.

AS FAR AS WE CAN TELL, THE GROWTH RATE WAS PRETTY MUCH THE SAME.

>> THIS QUESTION IS FOR DR. MASSA.

I WOULDN'T HAVE THOUGHT THERE WOULD BE CAREERS AT NASA IN GROWING PLANTS.

CAN YOU TALK A LITTLE ABOUT THE IMPORTANCE OF THIS AND WHY STUDENTS SHOULD CONSIDER COMING TO NASA?

>> GOOD QUESTION.

THE MORE I GET EXPOSED TO WHAT GOES ON AT NASA, THE MORE CAREERS I SEE.
THERE'S SO MANY THINGS THAT ONE CAN DO INVOLVED WITH SPACE FLIGHT, ALMOST ANYTHING THAT YOU CAN THINK OF.

THE PLANT SCIENCE FOR ME, I WAS INSPIRED BY AN EDUCATOR WHEN I WAS YOUNG WHO WAS INVITED HERE AND LEARNED ABOUT THE PLANT RESEARCH AT KENNEDY AND I JUST THOUGHT THE WHOLE THING WAS FASCINATING AND DECIDED THAT I WANTED TO DO THAT.

IT TOOK ME A WHILE, BUT I GOT HERE EVENTUALLY.

I'M VERY FORTUNATE TO BE DOING WHAT I DO BECAUSE I THINK IT'S AWESOME.

I THINK THERE ARE SO MANY INTERESTING CAREERS THAT STUDENTS CAN DO.

WHEN YOU PUT A SPACE SPIN ON
THINGS, IT JUST MAKES IT THAT MUCH COOLER.

WE'RE ALL PART OF THIS INCREDIBLE TEAM AND WE'RE ALL WORKING TOWARDS THE SAME GOALS.

WE CAN'T DO IT ALONE.

I THINK ANY CAREER THAT YOU ENGAGE IN, IF YOU THINK ABOUT WHAT WOULD THAT BE LIKE IF I DID IT WORKING FOR SPACE, IT JUST MAKES IT MUCH MORE INTERESTING, IN MY OPINION.

I'M A LITTLE BIASED.

>> THANKS, GIOIA.

WE HAVE ONE DOWN HERE?

>> I WAS JUST WONDERING, NOW THAT WE'VE GONE FROM PACKING A PICNIC BASKET FOR SPACE FLIGHT TO ACTUALLY BEGINNING TO GROW
ALONG THE WAY, ONE OF THE CROPS I'M INTERESTED IN ARE HERBS AND SPICES BECAUSE THOSE ARE THE ONES THAT CAN REALLY ADD FLAVOR TO THE CREW AND MIGHT BE OF GREAT INTEREST TO THEM.

>> IT'S DEFINITELY A REALLY IMPORTANT AREA.

THE RUSSIANS HAVE ALREADY DONE SOME WORK WHERE THEY GROW ONIONS IN SPACE AND THE CREW MIXES THEM WITH THE PACKAGED FOOD AND THAT SHOWS THAT THIS IS SOMETHING THAT'S DESIRABLE.

WITH THE FLUID SHIFT IN SPACE FLIGHT WHERE EVERYTHING POOLS UP IN YOUR HEAD AND YOU GET THE KIND OF PUFFY FACE, THE SENSE OF TASTE IS A LITTLE BIT MUTED.

FROM ANECDOTAL EVIDENCE, THE CREW REALLY WANTS THINGS LIKE HOT SAUCE AND SPICES BECAUSE THEY CAN'T TASTE THINGS QUITE AS
WELL WHICH IS WHY SOME OF THE
MORE STRONG FLAVORED VEGETABLES

MIGHT BE A LOT BETTER FOR SPACE
AS WELL.

BUT HERBS WOULD BE ANOTHER WAY
TO GET AT THAT.

WE'VE DONE SOME TESTING WITH
ONIONS IN THE PAST, CHIVES, ALSO
BASIL.

MINT COULD EASILY BE GROWN.

WE LOOKED AT OREGANO.

THAT WAS A LITTLE TRICKIER.

SOME OF THE WOODIER HERBS LIKE
ROSEMARY, THEY WOULD TAKE A
WHILE BUT THERE'S NO REASON THAT
THEY COULDN'T BE GROWN IF WE HAD
A DEDICATED SPACE STATION HERB
GARDEN.

>> I'D LIKE TO TAKE THAT ONE
QUESTION.
WHAT HERBS WOULD YOU GROW?

>> GARLIC.

HOW ABOUT YOU, RONNY?

WHAT WOULD YOU GROW ON THE WAY TO MARS?

>> BEEF.

>> I WAS THINKING OF A CUPCAKE PLANT MYSELF.

>> TOMATOES.

>> HOW ABOUT YOU, LISA?

>> I WOULD PROBABLY WANT SOME FRUIT LIKE BLUEBERRIES OR STRAWBERRIES, SOMETHING LIKE THAT.

>> ONE OF THE FRUIT THAT OUR TEAM IS LOOKING AT, GIOIA, YOU WANT TO LET THE CAT OUT OF THE BAG?

>> WE HAVE DONE WORK WITH
STRAWBERRIES IN THE PAST AND

00:37:49.719 --> 00:37:53.359
THAT'S A GOOD CANDIDATE BUT WE ARE CURRENTLY WORKING ON DWARF

00:37:53.360 --> 00:37:56.490
FRUIT TREES, SPECIFICALLY DWARF PLUMS.

00:37:56.489 --> 00:37:59.619
WE HAVE A NUMBER OF DWARF PLUMB LINES GROWING.

00:37:59.619 --> 00:38:01.539
THEY'RE AMAZING.

00:38:01.539 --> 00:38:05.599
THEY START FROM A SEED TO PRODUCING ANOTHER FRUIT WITHIN

00:38:05.599 --> 00:38:07.469
ABOUT A YEAR.

00:38:07.469 --> 00:38:10.189
IN TERMS OF FRUIT TREES THAT'S A VERY FAST LIFE CYCLE.

00:38:10.190 --> 00:38:15.920
THEY STAY VERY LOW, CREEPING, ALMOST A VINY TYPE PLUMB.

00:38:15.920 --> 00:38:19.579
WE'RE HOPING SOMETHING LIKE THAT CAN GO UP IN VEGGIE SOME TIME

00:38:19.579 --> 00:38:20.579
SOON.

00:38:20.579 --> 00:38:23.329
>> I'LL ADD, INTERESTING TO ME THAT I'VE LEARNED ABOUT THE

00:38:23.329 --> 00:38:27.299
PLUMS IS IT ACTUALLY HELPS WITH
BONE REMODELLING WHICH MEANS IT HELPS BUILD BONE COULD BE BENEFICIAL FOR FOLKS STEPPING OUT INTO THE SOLAR SYSTEM.

ANY OTHER QUESTIONS?

RIGHT UPFRONT HERE.

>> HI.

MY QUESTION IS FOR DR. MASSA.

VEGGIE, WHAT ARE SOME OF THE APPLICATIONS THAT VEGGIE HAS HERE ON EARTH AND SOME OF THE BENEFITS TO MANKIND HERE?

>> THAT'S A GREAT QUESTION.

AS RONNY ALLUDED TO, URBAN AGRICULTURE IS GETTING MORE
IMPORTANT.

THERE ARE A LOT OF PEOPLE ON THIS PLANET.

WE'RE GROWING ALL THE TIME AND A LOT OF PEOPLE LIVE IN URBAN AREAS.

THERE'S A LOT OF WORK GOING ON IN THE CONTROLLED ENVIRONMENT.

AGRICULTURE FIELD ON OPTIMIZING INDOOR PLANT PRODUCTION AND KIND.

OF SEEING HOW MANY PLANTS YOU CAN GROW IN A GIVEN VOLUME WHICH IS EXACTLY WHAT WE WANT TO DO FOR SPACE.

WE STOP THINKING ABOUT AREA AND WE START THINKING ABOUT VOLUME.

WE'RE LEARNING A LOT OF LESSONS WITH VEGGIE AND WE'RE GOING TO LEARN A LOT MORE WITH THE ADVANCED PLANT HABITAT ABOUT FUNDAMENTAL PLANT PHYSIOLOGY.
THERE'S BEEN DECADES OF RESEARCH HERE AT KENNEDY SPACE CENTER LOOKING AT LIGHTING SPECIFICALLY FOR PLANTS.

THAT'S WHY VEGGIE USES THE LIGHT EMITTING DIODES THAT YOU SEE.

IT CASTS A PURPLE LIGHT.

THIS IS BECAUSE WE'RE SPECIFICALLY TUNING THOSE LIGHTS TO THE FREQUENCIES THAT PLANTS NEED AND THE INTENSITIES THAT PLANTS NEED.

SUNLIGHT MIGHT BE FREE, BUT IT'S ACTUALLY NOT ALL THAT FREE WHEN YOU HAVE TO THINK OF THE COST OF COOLING AND OTHER ASPECTS OF USING SUNLIGHT.

IF WE CAN USE ELECTRIC LIGHTING TO CUSTOM LIGHT OUR PLANTS, WE CAN INCREASE THE PRODUCTIVITY, AND SO A LOT OF THIS RESEARCH...
HAS TRANSLATED INTO COMMERCIAL HORTICULTURAL AREAS.

IN TERMS OF THE MEDIA, THE SUBSTRATE, THE WATERING SYSTEM,

WE'RE LEARNING A LOT OF LESSONS FROM THAT AS WELL.

AND JUST THE TYPES OF CROPS, THAT'S A BIG ONE.

IF YOU'RE GROWING THINGS OUT IN YOUR GARDEN, YOU DON'T HAVE TO

WORRY ABOUT HOW BIG THE PLANTS ARE, BUT IF YOU'RE DOING THIS IN

A MORE URBAN SETTING OR INDOOR GARDENING, YOU WANT SMALL CROPS

THAT HAVE WHAT WE CALL A HIGH HARVEST INDEX WHICH IS THE

PROPORTION OF EDIBLE TO THE TOTAL YIELD.

THE STEMS AND LEAVES AREN'T SOMETHING YOU CAN EAT SO YOU

HAVE TO FIGURE OUT A WAY TO RECYCLE THAT TO RECAPTURE THOSE
00:40:59,039 --> 00:41:07,119
NUTRIENTS WHICH IS SOMETHING OUR
TEAM HAS WORKED ON AS WELL.

716
00:41:07,119 --> 00:41:10,630
ALL OF THESE LESSONS ARE GOING
TO TRANSLATE TO MORE SUSTAINABLE

717
00:41:10,630 --> 00:41:14,420
FOOD PRODUCTION FOR THE FUTURE.

718
00:41:14,420 --> 00:41:15,430
>> THANKS.

719
00:41:15,429 --> 00:41:17,940
WE HAVE ONE MORE QUESTION HERE.

720
00:41:17,940 --> 00:41:19,360
>> Hi.

721
00:41:19,360 --> 00:41:25,000
I WONDERED, BASICALLY ASTRONAUT
SCOTT KELLY HAD SAID WHEN HE

722
00:41:25,000 --> 00:41:28,940
TASTED THE LETTUCE THAT IT
TASTED LIKE ARUGULA.

723
00:41:28,940 --> 00:41:32,590
I KNOW IT WASN'T ARUGULA, SO I
JUST WONDERED WHAT WAS THE

724
00:41:32,590 --> 00:41:37,450
DIFFERENCE IN THE TASTE AND THEN
HOW DOES THE WATER GET ABSORBED

725
00:41:37,449 --> 00:41:38,449
IN THE SOIL?

726
00:41:38,449 --> 00:41:39,809
HOW DOES IT GROW?

727
00:41:39,809 --> 00:41:41,588
WHAT MAKES IT STICK?
>> THE ARUGULA COMMENT WAS REALLY INTERESTING BECAUSE WE

WERE WONDERING IF THE LETTUCE WOULD BE MORE BITTER.

IF YOU'VE GROWN LETTUCE IN YOUR GARDEN HERE, WHEN IT GETS A LITTLE OLD OR WHEN IT'S UNDER SOME STRESS, IT WILL GET A LITTLE MORE BITTER. LETTUCE IS ACTUALLY A LATEX BEARING PLANT AND IT CAN BUILD UP A LITTLE MORE OF THAT LATEX AND THAT GIVES IT A BITTER FLAVOR.

I THINK THE ARUGULA COULD HAVE BEEN BECAUSE THERE WAS SOME STRESS IN MICROGRAVITY AND THEN THERE WAS ALSO THE WATER STRESS THAT WE MENTIONED WHICH THE PLANTS KIND OF GREW OUT OF, BUT THAT COULD LEAVE A RESIDUAL FLAVOR.
BECAUSE OF THAT FLUID SHIFT, I THINK THEY PROBABLY REALLY ENJOYED THAT FLAVOR BECAUSE IT'S A STRONGER FLAVOR.

THE CABBAGE IS ACTUALLY MORE OF A BITTER GREEN THAN LETTUCE, AND EVERYONE SEEMS TO REALLY ENJOY THAT FLAVOR AS WELL.

IN TERMS OF HOW THE PLANTS ACTUALLY GROW, WE USE A BAKED CERAMIC.

I'M GOING TO PULL THIS GUY OUT.

THIS IS WHAT WE CALL A PLANT PILLOW.

THERE ARE SORT OF SMALL PARTICLES.

IT ALMOST LOOKS LIKE KITTY LITTER BUT IT'S NOT.

IT'S A BAKED CLAY.

THEN WE HAVE ALSO A CONTROLLED RELEASE FERTILIZER IN THERE, A
POLYMER-COATED FERTILIZER MIXED WITH THIS CLAY.

WE FILL UP THIS PLANT PILLOW WITH THAT AND PUT SOME WICK IN TO ACT AS A CONDUITS TO WATER.

YOU CAN SEE THAT THERE'S FABRIC ON THE WATER SO THIS ALLOWS THE PLANT TO WICK UP FROM A RESERVOIR THAT IT'S SITTING ON.

WE HAVE THE ABILITY TO ADD WATER DIRECTLY.

THE ASTRONAUTS START BY INITIALLY PRIMING THAT PILLOW.

EVERYTHING IS SENT UP COMPLETELY DRY.

THE SEEDS ARE PLANTED DRY.

THE PLANTS THAT WERE GROWN AND HARVESTED YESTERDAY ON SPACE STATION, THEY'VE BEEN UP THERE FOR A YEAR AND A HALF.

WE PLANTED THOSE SEEDS A LONG
TIME AGO.

00:43:39.739 --> 00:43:41.529
I GUESS THEY HAD BEEN PLANTED
FOR A YEAR AND A HALF.

00:43:41.530 --> 00:43:44.930
THEY'VE BEEN UP THERE FOR A BIT
OVER A YEAR, AND THEY STILL WERE

00:43:44.929 --> 00:44:23.849
VIABLE WHICH GOES TO SHOW THAT
SEEDS REALLY WILL STORE VERY

00:43:48.610 --> 00:43:51.019
WELL FOR LONG PERIODS OF TIME.

00:43:51.019 --> 00:44:00.659
WHEN THEY ADD WATER, THE SEEDS
START TO GERMINATE AND THE PLANT

00:44:00.659 --> 00:44:23.849
IS DRAWING WATER UP AND
TRANSPIRING IT THROUGH THE

00:44:01.659 --> 00:44:07.750
THAT WATER IS RECLAIMED ON SPACE
STATION AND RECYCLED AND REUSED.

00:44:07.750 --> 00:44:11.420
IT'S A NICE SYSTEM FOR CLEANING
YOUR WATER AS WELL.

00:44:11.420 --> 00:44:17.119
THEN THE PLANTS JUST GROW UNTIL
YOU HARVEST THEM.

00:44:17.119 --> 00:44:23.849
>> LOOKS LIKE WE HAVE A QUESTION
DOWN HERE.

00:44:23.849 --> 00:44:27.539
>> YOU MENTIONED YOU GREW LETTUCE LAST YEAR SO THIS IS THE
SECOND GROWOUT.

HAVE YOU SEEN ANY DIFFERENCE BETWEEN GROWOUTS AT THIS EARLY
STAGE?

AND THE SECOND QUESTION, DO WE HAVE ANYTHING ELSE TO GROW?

WE REALLY HAVEN'T SEEN TOO MANY DIFFERENCES.

I THINK THE GERMINATION AND GROWTH RATE WERE VERY SIMILAR.

WE SAW THE PLANTS GROW A LITTLE BETTER THIS TIME THAN LAST TIME.

WE DID HAVE TO HAVE THE CREW ADD WATER DIRECTLY TO THOSE PLANT
PILLOWS AT ABOUT THE SAME TIME AS LAST TIME.

WE HAD MORE PLANTS GROW THIS TIME WHICH WAS GREAT.

IN TERMS OF THE SEEDS BEING STORED FOR SO LONG, I DON'T
THINK THAT WAS AN ISSUE.

WE MAY HAVE HAD A LITTLE BIT LOWER GERMINATION, A COUPLE OF SEEDS—PILLOWS THAT ONLY HAD ONE SEED COME OUT WHEN WE PUT TWO IN EACH ONE, BUT WE'LL HAVE TO LOOK AT THAT.

WE HAVE ONE ADDITIONAL SET OF PLANT PILLOWS UP THERE.

IF YOU SEE OUR LOGOS ON A LOT OF OUR SHIRTS HERE, THERE ARE SOME FLOWERS ON THEM AND THOSE ARE THE ZINNIAS.

ORIGINALLY WE HAD SENT TWO SETS OF LETTUCE AND A SET OF ZINNIAS.

ZINNIAS ARE SMALL LITTLE DAISY-LIKE PLANTS.

WE TESTED THOSE BECAUSE WE WEREN'T SURE IF THE CREW WOULD BE ABLE TO EAT THE PRODUCE RIGHT AWAY AND WE WANTED THEM TO HAVE SOMETHING THEY COULD GROW AND ENJOY WHILE THEY WERE WAITING.
FOR US TO GET THE DATA AND TO GET ALL OF THE APPROVALS THAT WE NEEDED FOR THE CREW TO ACTUALLY EAT WHAT THEY GREW.

SO WE SENT THE ZINNIAS UP THERE AND THEY'RE STILL THERE.

WE'RE HOPING THAT NOW THAT THEY'VE GOTTEN A TASTE FOR GROWING CROPS UP THERE THAT THE CURRENT CREW WILL BE INTERESTED IN GROWING THOSE.

THEN AGAIN, AS TRENT SAID, WE'LL SEND SOME MORE PILLOWS UP ON THE NEXT SPACE-EX MISSION AS WELL WITH THE CABBAGE AND MORE LETTUCE.

>> I CAN ADD TO THAT A LITTLE BIT.

THE REASON WHY WE HAD A SECOND CROP OF LETTUCE RATHER THAN THE ZINNIAS WAS CREW TIME.
WE ARE VERY, VERY CHALLENGED WITH CREW TIME.

WHEN COMMERCIAL CREW GETS FLYING AND WE HAVE THAT 7th CREW MEMBER ON SPACE STATION AND WE DOUBLE THE RESEARCH TIME, HOPEFULLY WE'LL GET A LOT MORE RESEARCH DONE AND AS A VEGGIE GUY OF COURSE I'M HOPING TO GET MORE CROPS GROWN.

I JUST WANTED TO MENTION THAT.

BRIAN, PLEASE.

>> QUICK QUESTION.

IF YOU GET THE DREAM PAYLOAD OF SOMETHING THAT MAKES STEAK, IS THERE A CHANCE OF GROWING A POTATO OR SOMETHING WITH VEGGIE?

IS THAT A POSSIBILITY?

>> FOR THE BELOW GROUND CROPS WE'LL NEED TO DESIGN SOMETHING A
LITTLE DIFFERENT THERE THE PILLOWS.

WE CAN GROW A RADISH WHERE IT POPS UP ABOVE THE TOP WHERE MOST OF THE ROOTS ARE GROWN BELOW GROUND.

WE WOULD NEED TO DESIGN A SLIGHTLY DIFFERENT ROOTING SYSTEM BECAUSE RIGHT NOW THEY DON'T HAVE A WAY TO OPEN THESE PILLOWS AND ACCESS THEM.

BUT IT'S TOTALLY POSSIBLE.

I KNOW YOU DON'T LIKE POTATOES, JANET, BUT WE ACTUALLY HAVE DONE A TREMENDOUS AMOUNT OF POTATO RESEARCH HERE AT KENNEDY SPACE CENTER AND GROWN WORLD RECORD YIELDS OF POTATOES IN CHAMBERS.

THAT WE'VE HAD HERE.

WE HAVE ONE OF THE WORLD POTATO EXPERTS WHO'S A PLANT
PHYSIOLOGIST HERE AND A MEMBER OF OUR VEGGIE TEAM.

I THINK WE COULD TOTALLY MODIFY FOR POTATOES.

THEY’VE EVEN GROWN PEANUTS AND THEY ARE A COOL CROP BECAUSE THEY BURY THEIR FLOWER STOCK.

AND THAT’S WHERE THE NUT FORMS.

IT’S UNDERGROUND.

SO THEY HAD TO DESIGN A WHOLE MODIFIED SYSTEM SPECIFICALLY TO ALLOW THAT TO HAPPEN.

WE HAVE AN INCREDIBLE TEAM OF ENGINEERS WHO ARE REALLY CREATIVE, SO I THINK WE CAN COME UP WITH SOMETHING.

>> MY QUESTION IS ACTUALLY FOR THE OTHER THREE MEMBERS OF THE PANEL.
I AM AN EDUCATOR.

I TEACH MIDDLE AND HIGH SCHOOL STUDENTS OVER IN ORLANDO.

I'VE HAD THE TREMENDOUS HONOR OF BEING ABLE TO WORK WITH THE VEGGIE TEAM FOR THE PAST THREE SUMMERS AND TAKEN THE INFORMATION THAT I'VE LEARNED ABOUT THE RESEARCH AND INTEGRATED IT INTO MY CLASS LESSON PLANS AND SHARED IT WITH OTHER TEACHERS.

ONE OF THE WONDERFUL THINGS ABOUT VEGGIE IS THAT MY STUDENTS CONNECT VERY EASILY WITH VEGGIE BECAUSE THEY CAN RELATE TO THE LETTUCE.

I WANTED TO ASK THE OTHER PANEL MEMBERS IN REGARDS TO COMMERCIAL CREW, INTERNATIONAL SPACE STATION, AND KENNEDY SPACE
CENTER, IF YOU HAD THE OPPORTUNITY TO TALK WITH MIDDLE SCHOOL AND HIGH SCHOOL STUDENTS, WHAT WOULD YOU SHARE WITH THEM?

THAT YOU FEEL WOULD HELP THEM -- THAT WOULD EASILY HELP THEM CONNECT WITH THE VERY IMPORTANT MESSAGE THAT ALL THREE OF YOU COULD SHARE WITH THEM ABOUT YOUR PROGRAM?

>> WHO WANTS TO GO FIRST?

I THINK GIOIA TOUCHED ON IT A LITTLE BEFORE.

I CAME INTO NASA LATE AND I HAD A VISION, EVEN THOUGH I GREW UP RIGHT OUTSIDE THE GATES, THAT EVERYBODY INSIDE THE GATES OF THE SPACE CENTER LIKE THESE WORLD CLASS LAB COAT-WEARING DESIGN TESTS AND ENGINEERS AND SHE TOUCHED ON IT BEFORE,

THERE'S A JOB FOR ANYONE IN ANY FIELD AT THE SPACE CENTER.
I look at Chris and the guys who work in the com area, English majors and communications majors probably don't realize that there's a huge career opportunity at NASA and it's just as important as anything any of us do.

People who work with their hands, machinists, there's just such a variety of potential careers.

I don't think we do a good job of selling that because I think the general community and the school kids think if it's not traditional STEM, they have no place in NASA.

I think -- just to tell you something that we've been talking about recently, there's an initiative going on that the
ISS PROGRAM IS WORKING CALLED HUNCH WHICH WORKS WITH HIGH SCHOOL STUDENTS, PALM BAY PARTICULARLY THAT WE SUPPORT,

WHERE KIDS ARE MACHINISTS OR THEY'RE USING THE SEWERS, STUFF FROM THE FASHION DESIGN, TO BUILD SPACE FLIGHT HARDWARE FOR NASA.

TO ME, TALKING ABOUT GETTING KIDS EXCITED AND KEEPING THEM IN SCHOOL, THAT'S THE KIND OF STUFF THAT WILL DO IT.

FIRST OF ALL, I CAN APPRECIATE YOU AS A TEACHER, YOU BEING HERE AND TRANSLATING INFORMATION TO STUDENTS IS PROBABLY THE BEST THING TO DO, HONESTLY.

ANYTHING THAT YOU TAKE BACK, THEY'RE GOING TO RELATE TO YOU AND THEREFORE THEY'RE GOING TO PROBABLY GET INTERESTED IN THE
SO I REALLY APPRECIATE YOU BEING HERE AND DOING THAT FOR US BECAUSE IT'S REALLY EVERYBODY GETTING THE WORD OUT THAT REALLY AFFECTS AND CONNECTS WITH PEOPLE.

FROM A COMMERCIAL CREW STANDPOINT, I THINK ONE THING IS HUMAN SPACE FLIGHT IS KIND OF COOL IN GENERAL.

IF YOU'VE EVER HAD AN OPPORTUNITY FOR YOUR KIDS, YOU'RE CLOSE ENOUGH THAT ONCE WE'RE STARTING TO HAVE launches AGAIN WITH PEOPLE ON BOARD, HUMANS ON BOARD, THAT'S JUST

I DON'T KNOW IF THERE'S ANYTHING ELSE THAT CAN RECREATE THAT

EXCITEMENT AND THAT FEELING WHEN YOU'RE STANDING THERE AND REALIZING THERE ARE PEOPLE THAT...
ARE BEING LAUNCHED.

00:51:52,820 --> 00:51:57,650
THAT'S ONE WAY.
AND THEN I FEEL LIKE IT'S A

00:51:57,650 --> 00:52:03,099
LITTLE BIT RELATABLE BUT AT SOME
POINT, THERE WAS A TIME WHEN THE

00:52:03,099 --> 00:52:06,630
GENERAL PUBLIC DIDN'T HAVE
CAPABILITY OR ACCESS TO FLYING

00:52:06,630 --> 00:52:07,630
ON AN AIRPLANE.

00:52:07,630 --> 00:52:12,619
IT WAS LIMITED TO JUST A FEW
MILITARY AND -- IT WAS A VERY

00:52:12,619 --> 00:52:14,900
SMALL PERCENTAGE OF THE
POPULATION.

00:52:14,900 --> 00:52:18,389
THERE'S GOING TO BE A DAY WHERE
THEY'RE GOING TO BE BUYING

00:52:18,389 --> 00:52:22,519
SEATS, BUYING RIDES TO GO TO
SPACE.

00:52:22,519 --> 00:52:28,380
I THINK THEY CAN RELATE TO GOING
FURTHER AND DOING DIFFERENT

00:52:28,380 --> 00:52:29,380
THINGS.

00:52:29,380 --> 00:52:34,369
BUYING A SEAT ON A SPACE PLANE
WILL BE KIND OF COOL AND AT SOME

00:52:34,369 --> 00:52:38,960
POINT WE'RE GOING TO BE ABLE TO DO THAT.

>> I WOULD ALSO LIKE TO THANK YOU FOR BEING A TEACHER.

I HAVE A NUMBER OF RELATIVES, MY SISTER IS A TEACHER, A BUNCH OF FRIENDS IN ORLANDO AS WELL AS MY DAUGHTER-IN-LAW IN VARIOUS GRADE LEVELS FROM FIRST GRADE UP THROUGH HIGH SCHOOL.

SO I APPLAUD YOU FOR THAT.

AND I KNOW HOW DIFFICULT IT IS FOR TEACHERS TO BE ABLE TO INTRODUCE CURRICULUM AND INTRODUCE TOPICS THAT ISN'T EXACTLY WHAT'S ON THEIR LESSON PLAN.

SO I REALLY APPRECIATE YOU REACHING OUT.

I WOULD ENCOURAGE YOU TO WE HAVE A LOT OF PROGRAMS NOT JUST HERE AT KENNEDY SPACE CENTER BUT THROUGHOUT THE AGENCY WHERE WE
INTERACT WITH THE EDUCATOR COMMUNITY.

OUR OFFICE OF EDUCATION AT THE AGENCY LEVEL, WE RUN A NUMBER OF THESE AGENCY PROGRAMS RIGHT HERE FROM KENNEDY SPACE CENTER THAT I WOULD BET THAT MOST TEACHERS-- I KNOW THE ONES THAT EVEN MY FRIENDS AND FAMILY, THEY DON'T KNOW ANYTHING ABOUT IT.

IT'S BECAUSE OF THE TIME THAT YOU HAVE AS A TEACHER TO BE ABLE TO LOOK OUT AND SEE WHAT ELSE IS AROUND IN THE COMMUNITY.

IF I WERE TO HAVE MY DREAM MOMENT, IT WOULD BE ABLE TO GET THE EDUCATORS IN A ROOM AND JUST HAVE FOR A COUPLE HOURS OR

WHATEVER AND TALK TO THEM ABOUT THE EXISTING PROGRAMS THAT WE HAVE AVAILABLE TO THEM NOT JUST HERE AT KENNEDY SPACE CENTER BUT
THROUGHOUT THE AGENCY.

00:54:04,210 --> 00:54:06,619
WE HAVE A GREAT EDUCATOR RESOURCE CENTER THAT I THINK

00:54:06,619 --> 00:54:08,799
HARDLY EVER GETS USED.

00:54:08,800 --> 00:54:11,769
WE DO HAVE A PROGRAM WHERE I THINK IT'S THE SIXTH GRADERS

00:54:11,769 --> 00:54:14,949
COME AND VISIT AT OUR VISITOR'S CENTER FOR FREE A DAY IN

00:54:14,949 --> 00:54:18,779
DECEMBER WHICH IS GREAT AT INSPIRING THE KIDS BUT I THINK

00:54:18,780 --> 00:54:22,850
THAT JUST TOUCHES THE TIP OF THE ICEBERG ON WHAT

00:54:22,849 --> 00:54:27,360
WE ACTUALLY HAVE AVAILABLE AND WHAT WE COULD AFFORD OR WHAT WE

00:54:27,360 --> 00:54:31,420
COULD OFFER TO EDUCATORS THAT WOULD ENRICH THEIR STUDENTS' LIVES.

00:54:31,420 --> 00:54:33,099
ONE LAST THING THAT I THOUGHT WAS INTERESTING BECAUSE I HAVE A

00:54:33,099 --> 00:54:34,750
DAUGHTER AND WE WERE TALKING ABOUT DIFFERENT CAREERS AT NASA

00:54:34,750 --> 00:54:38,429

00:54:38,429 --> 00:54:41,409
AND I WAS TALKING TO DR.

00:54:41,409 --> 00:54:44,009
NEWMAN
ABOUT SHE'S INTERESTED IN

00:54:44,010 --> 00:54:45,010
FASHION DESIGN.

00:54:45,010 --> 00:54:50,430
I'M LIKE, COME ON, DON'T YOU
WANT TO DO THE STEM STUFF.

00:54:50,429 --> 00:54:55,579
DAVA IS A PHD AND SHE DOES THE
SPACE SUIT THING AND SHE SAID

00:54:55,579 --> 00:54:59,269
THINK ABOUT THE IMPACT OF
GETTING GIRLS AND YOUNG WOMEN

00:54:59,269 --> 00:55:05,670
WHO MIGHT BE INTERESTED IN
FASHION DESIGN INTO DESIGNING

00:55:01,909 --> 00:55:05,670
THE NEXT GENERATION SPACE SUITS,
SO I THOUGHT THAT WAS A COOL

00:55:05,670 --> 00:55:06,670
CONNECTION.

00:55:06,670 --> 00:55:10,230
I THINK IF WE CONTINUE TO LOOK
TO MAKE THOSE CONNECTIONS, WE'LL

00:55:10,230 --> 00:55:13,559
BE ABLE TO HELP DO WHAT YOU'RE
ALREADY DOING.

00:55:13,559 --> 00:55:14,559
>> AWESOME.

00:55:14,559 --> 00:55:15,820
THANKS SO MUCH.
DO WE HAVE ONE LAST QUESTION FROM THE AUDIENCE?

RIGHT DOWN HERE IN FRONT.

GOOD AFTERNOON, EVERYONE.

I WAS WONDERING IF WE END UP HAVING THE LONG-TERM GARDEN IN THE SPACE STATION, IS THERE A PLAN TO REPLENISH THE MINERALS IN THE CLAY BECAUSE I KNOW THAT A LOT OF MINERALS ARE TAKEN BY THE VEGETABLES.

HOW WE WOULD MAINTAIN THE MINERALS AND RECYCLE THEM WHEN WE HAVE MARTIAN GARDENS SO TO SPEAK.

COMPOSTING WOULD BE ONE.

I KNOW SOME OF OUR TEAM HERE ARE WORKING ON ASH AND I'LL TURN THAT OVER TO GIOIA BECAUSE I THINK SHE KNOWS A LITTLE BIT
MORE ON THAT AND MAYBE TALK ABOUT HOW WE GET THERE.

>> THAT'S AN EXCELLENT QUESTION.

THIS IS NOT FOR LONG TERM.

THIS IS FOR MICROGRAVITY AND EVERYTHING HAS TO BE CONTAINED

BUT THERE'S NOT AN EASY WAY TO CLEAN OUT THOSE PILLOWS, TO REPLANT THEM.

WE'VE DONE A LOT OF WORK HERE ON HYDROPONICS WHICH IS A GREAT TECHNIQUE BECAUSE YOU CAN HAVE THE NUTRIENTS IN A SOLUTION.

WE'VE DONE A LOT OF WORK ON COMPOSTING WHERE YOU CAN TAKE THE INEDIBLE PLANT WASTE AND USE MICROORGANISMS, BACTERIAL BIOREACTORS TO RECLAIM THOSE NUTRIENTS.

WE HAVE VERY ACTIVE WORK ON WATER PROCESSING HERE, TAKING
GRAY WATER, WASH WATER, AND OTHER TYPES OF DIRTY WATER AND

BEING ABLE TO RECLAIM THE NUTRIENTS OUT OF THAT USING

BACTERIA AND THEN YOU COULD FEED THOSE NUTRIENTS INTO THE PLANTS.

IT'S ALL PART OF THIS GREATER KIND OF REGENERATIVE SUSTAINABLE LIFE SUPPORT SYSTEM AND USING BIOLOGY.

AS TRENT WAS SAYING, WE HAVE A BIG PROJECT RIGHT NOW ON BIO-CHAR.

THAT'S TAKING THE PLANT WASTE AND ESSENTIALLY MAKING CHARCOAL OUT OF IT AND MIXING THAT IN WITH GROWTH MEDIA.

WE'RE INTERESTED IN LOOKING AT MARS REG A-LIST TO BE ABLE TO STUDY HOW WELL PLANTS WOULD GROW IN THAT.

IF YOU WANT TO HAVE A SUBSTRATE
TO HELP SUPPORT THE PLANTS,

00:57:33,329 --> 00:57:37,090
MAYBE THE NUTRIENTS ARE COMING
FROM THE SOLUTION BUT THE

00:57:37,090 --> 00:57:42,640
REGALIS CAN SUPPORT THE ROOTS
AND GIVE THEM SOMETHING TO GROW

00:57:42,639 --> 00:57:43,650
IN.

00:57:43,650 --> 00:57:45,230
WE HAVE A LOT OF DIFFERENT
AREAS.

00:57:45,230 --> 00:57:49,019
WE HAVEN'T REALLY SOLVED ALL OF
THOSE PROBLEMS BUT THERE'S A LOT

00:57:49,019 --> 00:57:51,000
OF RESEARCH THAT NEEDS TO BE
DONE.

00:57:51,000 --> 00:57:59,509
IF YOU'RE INTERESTED, WE COULD
USE ALL THE HELP WE CAN GET.

00:57:59,510 --> 00:58:03,190
>> ON OUR WAY TO MARS, WE'RE
GOING TO GROW PLANTS.

00:58:03,190 --> 00:58:07,802
WE HAVE THE KENNEDY SPACE CENTER
GETTING READY FOR THE MULTI-USER

00:58:07,802 --> 00:58:09,430
SPACE PART AND SUPPORTING THE
PLANT BIOLOGY WE DO ON THE SPACE

00:58:09,429 --> 00:58:14,839
STATION.
UTILIZING SPACE STATION AS A STEPPING STONE AND THE

1013
00:58:14,840 --> 00:58:18,039
COMMERCIAL CREW ARE GOING TO DOUBLE OUR TIME ON SPACE STATION

1014
00:58:18,039 --> 00:58:23,070
AND BRING BACK OUR CAPABILITY TO FLY FROM THE UNITED STATES.

1015
00:58:23,070 --> 00:58:24,320
THANK YOU ALL.

1016
00:58:24,320 --> 00:58:28,920
IF YOU WANT TO LEARN MORE YOU CAN GO TO NASA.GOV/ISS.

1017
00:58:28,920 --> 00:58:29,920
THANK YOU AGAIN.

1018
00:58:29,920 --> 00:58:30,920
I REALLY APPRECIATE IT.

1019
00:58:30,920 --> 00:58:30,921
[ ◆APPLAUSE◆ ]