WELCOME TO EARTH EXPEDITIONS- AN IN DEPTH LOOK AT HOW NASA STUDIES EARTH, BEYOND SATELLITES.

THE VIEW FROM SPACE GIVES US A GLOBAL PICTURE, BUT WE GO CLOSER TO THE GROUND TO GET A GRANULAR VIEW OF WHAT'S GOING ON BY USING SHIPS, AIRCRAFT, GROUND STATIONS AND OUR OWN EYES.

WE CALL THESE CLOSER LOOKS “FIELD CAMPAIGNS”.

NASA HAS A LONG HISTORY OF FIELD CAMPAIGNS.

JUST IN THE PAST MONTHS, NASA SCIENTISTS HAVE BEEN ALL OVER THE WORLD—FROM THE GLACIERS IN GREENLAND TO THE FORESTS OF SOUTH KOREA, TO THE CRASHING WAVES OF THE NORTH ATLANTIC.

WE'RE GETTING THE DATA THAT IS REVEALING THE SECRETS ABOUT OUR CHANGING PLANET.

ALOHA! AND WELCOME BACK TO NASA'S EARTH EXPEDITIONS.

TODAY WE'RE GOING TO HAWAII TO STUDY ONE OF THE MOST DYNAMIC AND EXCITING PARTS OF THE EARTH SYSTEM, CORAL REEFS.
THEY'RE A SOURCE FOR FOOD, MEDICAL ADVANCES, TOURISM.

AND THEY'RE AMAZING—HARD CORALS HAVE ACTUALLY OUTLIVED DINOSAURS!

IF YOU SEARCH ONLINE FOR “CORAL REEF IMAGES” YOU PROBABLY THINK WE KNOW A LOT ABOUT THEM.

WE SIMPLY DON'T HAVE ENOUGH DATA TO UNDERSTAND WHICH IMPACTS TO THE REEF ARE THE MOST DAMAGING.

AND THAT MAKES IT IMPOSSIBLE TO FIGURE OUT HOW REEFS ARE GOING TO CHANGE IN THE FUTURE.

SO THAT'S WHY WE'RE SENDING OUT NASA'S MISSION APPROPRIATELY NAMED CORAL, THE CORAL REEF AIRBORNE LABORATORY.

CORAL WILL LOOK AT HOW REEFS ARE RESPONDING TO OUR CHANGE GOING ON IN OUR OCEANS RIGHT NOW.

WITH TEAMS HIGH IN THE AIR AND DIVERS DOWN IN THE OCEAN.

TO LEARN MORE, LET'S HEAR FROM MICHELLE IN HAWAII.

[MUSIC]
HEY EVERYBODY.

MY NAME IS MICHELLE GIERACH, AND I AM THE PROJECT SCIENTIST FOR THE CORAL REEF AIRBORNE LABORATORY, OR CORAL MISSION.

RIGHT NOW WE ARE AT AIR SERVICE HAWAII WITH THE HEART AND SOUL OF THE CORAL MISSION WHICH IS THE TEMPUS SUPPLIED SOLUTIONS GULF STREAM IV, OR G4.

WHAT MAKES THIS AIRCRAFT SO IMPORTANT TO CORAL IS WHAT IT HAS WITHIN, INSIDE THE PLANE.

IT IS THE PORTABLE REMOTE IMAGING SPECTROMETER, OR PRISM INSTRUMENT, AND IT SEES THROUGH THE BOTTOM OF THE PLANE TO ASSES CORAL REEF CONDITION AT 28,000 FEET ABOVE THE OCEAN SURFACE.

WE ARE IN HAWAII AS PART OF, ONE OF OUR FIELD CAMPAIGNS, SPECIFICALLY OUR OPERATIONAL READINESS TEST IN WHICH WE HAVE AN IN-WATER TEAM IN KANEOHE BAY TAKING OBSERVATIONS.

WE'LL HAVE THE G4 FLYING OVER COLLECTING OBSERVATIONS.

THE TWO TOGETHER PROVIDES AN INDICATION OF WHAT THE CORAL REEF CONDITION IS WITHIN KANEOHE.
BAY. AND THIS IS, SORT OF THE NEXUS OF CORAL - THE IN-WATER WITH THE AIRCRAFT TO GIVE A BETTER UNDERSTANDING OF WHAT ARE OUR CORAL REEF S CURRENTLY UNDERGOING, AND HOW WILL THEY CHANGE IN RESPECT TO CLIMATE.

SO THIS MISSION IS GOING TO HELP US UNDERSTAND CORALS A LOT BETTER THAN WE KNOW RIGHT NOW. I THINK SOMETHING PEOPLE NEED TO REALIZE IS THAT THOSE CORALS ARE DYNAMIC FEATURES. THEY CAN LIKE SHRINK AND GROW JUST LIKE A NATURAL THINGS, THE FORCE THINGS HAPPENING IN CLIMATE RIGHT NOW THEY'RE CAUSING MASSIVE CHANGES AND WE NEED TO UNDERSTAND. WE NEED TO UNDERSTAND HOW THEY ARE CONNECTING UP TO THE CORALS AND THAT'S WHY THE CORAL MISSION IS SO IMPORTANT.

Yeah it's very unexpected so earlier we actually did another mission ocean melting Greenland to measure glaciers.
SO HOW IS CORAL AND THESE GLACIERS IN GREENLAND SIMILAR?

YEAH SO YOU THINK ABOUT IT THE OCEAN IS ONE OF THE MOST POWERFUL COMPONENTS OF THE EARTH SYSTEM IT STORES A LOT OF HEAT AND IN THE CASE OF OCEANS MELTING GREENLAND OR EVEN UNDERSTANDING THE REEFS WE'RE DOING A COMBINATION OF THINGS, WE GOT THESE SATELLITES GOING ACROSS THE SKY YOU KNOW TAKING PICTURES LOOKING DOWN AND THEN WE HAVE OUR AIRPLANES YOU KNOW THE AIRPLANES GOING ACROSS AT THE LOWER LEVEL AND THEY'RE DOING THINGS LIKE IN OCEAN MELTING GREENLAND YOU'RE ACTUALLY DROPPING LITTLE SENSORS INTO THE OCEAN THAT ACTUALLY PUT A STRING OUT TO UNDERSTAND THE TEMPERATURE AND THE COMPOSITION BUT THEN FOR ALL THESE MISSIONS TOO WE PUT PEOPLE RIGHT DOWN IN THE WATER IN BOATS WE PUT PEOPLE OVER THE SIDE AND ALL THIS STUFF HAS TO COME IN CONCERT TO HELP US REALLY UNDERSTAND THE EARTH SYSTEM.

RIGHT, RIGHT.

EVEN COMPUTER MODELS AT THE END OF THE DAY
WHICH IS WHAT WE PUT THIS INTO

61
00:03:47,468 --> 00:03:52,968
SO SAY YOU'RE YOUNG PERSON IN HIGH SCHOOL
OR COLLEGE, AND YOU WANT TO LEARN HOW TO BE

62
00:03:52,968 --> 00:03:54,568
A SCIENTIST INVOLVED WITH THESE MISSIONS?

63
00:03:54,568 --> 00:03:56,218
HOW DOES NASA HELP?

64
00:03:56,218 --> 00:03:58,370
NASA IS ALL ABOUT STEM EDUCATION.

65
00:03:58,370 --> 00:04:03,218
SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS
ARE THE BASIS FOR WHAT NASA DOES, SO WE HAVE

66
00:04:03,218 --> 00:04:07,299
PROGRAMS LIKE THE NASA STUDENT AIRBORNE RESEARCH
PROGRAM THAT HELP GET THE CAREER BALL ROLLING.

67
00:04:07,299 --> 00:04:11,730
LET'S HEAR FROM EMILY, OUT AT NASA'S ARMSTRONG
FLIGHT RESEARCH CENTER IN PALMDALE, CALIFORNIA

68
00:04:11,729 --> 00:04:12,729
FOR MORE DETAILS.

69
00:04:12,729 --> 00:04:14,859
[MUSIC]
HI, I'M EMILY SCHALLER, AND I'M THE PROJECT

70
00:04:14,860 --> 00:04:19,400
MANAGER FOR A NASA SUMMER INTERNSHIP CALLED
THE STUDENT AIRBORNE RESEARCH PROGRAM, OR

71
00:04:19,399 --> 00:04:20,399
NASA SARP.

72
00:04:20,399 --> 00:04:24,519
I'M HERE AT NASA ARMSTRONG FLIGHT RESEARCH
CENTER IN PALMDALE, CALIFORNIA.
As you can see, this is a massive hangar for NASA's flying laboratories, including this plane, the DC-8, which is used for earth science research all over the world.

Thirty-two students from thirty-two different colleges and universities from across the United States just flew onboard the DC-8 over southern and central California.

SARP is an opportunity of a lifetime.

Students get an end-to-end, hands-on research experience in all aspects of an airborne earth science campaign.

They have the opportunity to work side-by-side with NASA scientists, pilots and engineers.

This year, students are collecting data with a suite of instruments used by the recently completed Korea U.S. air quality mission, or KORUS-AQ.

Students help operate scientific instruments in-flight in conditions not typically flown on commercial aircraft.
STUDENTS ALSO COLLECT DATA AT GROUND SITES IN CALIFORNIA, AND ALONG THE COAST.

IN ADDITION TO THE DC-8, STUDENTS WILL ALSO USE AIRBORNE IMAGING DATA COLLECTED FROM THE NASA ER-2 HIGH ALTITUDE RESEARCH AIRCRAFT.

BY THE CONCLUSION OF THE PROGRAM, EACH STUDENT DEVELOPS AN INDIVIDUAL RESEARCH PROJECT FROM DATA COLLECTED IN THE AIR, ON THE GROUND, AND FROM SATELLITES.

THE GOAL OF SARP IS TO TRAIN THE NEXT GENERATION OF EARTH SYSTEM SCIENTISTS AND ENGINEERS.

MANY SARP ALUMNI HAVE GONE ON TO PARTICIPATE IN OTHER NASA AIRBORNE RESEARCH MISSIONS.

AND SOME HAVE EVEN COME BACK TO SARP AS MENTORS.

THE STUDENT AIRBORNE RESEARCH PROGRAM WRAPS UP IN IRVINE, CALIFORNIA IN AUGUST.

BUT FOR MANY OF THESE STUDENTS, THIS EXPERIENCE COULD LAUNCH THEIR CAREERS IN EARTH SYSTEM SCIENCE.
SCIENTIST IS THAT IT’S NOT A CAREER OPPORTUNITY THAT A LOT OF PEOPLE EVEN KNOW IS OUT THERE.

SO WE RUN PROGRAMS LIKE SARP TO GET YOUNG PEOPLE ENGAGED.

EDUCATION IS IMPORTANT, AND SO IS FIELD RESEARCH.

BUT GET OUT IN THE FIELD, AND BE A PART OF A RESEARCH TEAM YOU HAVE TO HAVE ADAPTATION SKILLS AND YOU HAVE TO KNOW HOW ASK FOR HELP IN THOSE DIFFICULT SITUATIONS.

AND SOMETIMES IN AN AIRBORNE MISSION, YOU MAY FIND YOURSELF WITHOUT AN AIRPLANE...

EVERY YEAR YOU START OUT WITH ZERO.

ZERO MILES FLOWN, ZERO DATA COLLECTED.

THIS YEAR, ICEBRIDGE STARTED OUT WITH YET ANOTHER BIG ZERO THERE WERE NO AIRCRAFT AVAILABLE FOR THE MISSION, AS NASA'S DECADES-OLD P-3 WAS GETTING RE-WINGED.

SO THE TEAM TURNED TO THEIR FRIENDS AT NOAA FOR HELP.

AND THEY GOT...
MISS PIGGY, ANOTHER P-3 AIRCRAFT AND A VETERAN
OF 88 HURRICANE MISSIONS FROM FLOYD TO FRANCES TO KATRINA, OPERATED BY A CRACK FLIGHT CREW READY TO TACKLE THE FAR FROZEN NORTH FOR THE FIRST TIME.

AFTER INSTALLING ICEBRIDGE’S MANY INSTRUMENTS INTO THE AIRCRAFT, PERFORMING NEEDED MAINTENANCE, AND FLYING A FEW TEST FLIGHTS OVER TAMPA BAY, THE ICEBRIDGE TEAM WAS FINALLY READY TO GO.

THE TEAM’S FIRST TARGET WAS TO TAKE MEASUREMENTS OF SEA ICE IN THE ARCTIC OCEAN, AND AFTER A FEW WEEKS, ICEBRIDGE HAD ACHIEVED SOLID COVERAGE OF THE WESTERN ARCTIC BASIN, AND ON ONE MISSION, EVEN GRAZED THE NORTH POLE ITSELF, COMING WITHIN 200 METERS OF THE TOP OF THE WORLD.

FROM THERE, THE MISSION CHANGED ITS FOCUS TO NORTHERN LAND ICE, AND AFTER WAITING DAYS FOR THE FOG TO LIFT, FINALLY MANAGED TO HIT A CRUCIAL TARGET – THE ZACHARIAE ISSTROM.

THIS MASSIVE GLACIER DRAINS 5% OF THE GREENLAND ICE SHEET, AND IN 2012, ENTERED INTO A PHASE
OF RAPID RETREAT, MAKING REPEAT MEASUREMENTS ALL THE MORE CRUCIAL.

PLANES IN THE AIR AND CORAL IN THE SEA.

GLACIERS IN THE OCEAN AND AEROSOLS IN THE AIR.

SAT话语TES AND DIVERS.

SCUBA DIVERS AND FIRE FIGHTERS.

ANCIENT MAPS AND MODERN MARVELS.

YOU'RE WINNING THIS IS REALLY HARD.

[LAUGHTER]

IT WAS YOUR IDEA TO HAVE THE MAPS.

IT WAS MY IDEA TO HAVE THE MAPS.

ANYWAY YOUR PLANET IS CHANGING, AND WE'RE ON IT

KICK IT DJ
[MUSIC]

00:08:34,490 --> 00:08:35,490
YEAH I GOT YOU, I GOT YOU YEAH AND I LETS
DO ALLITERATIONS IT’LL BE A FUN GAME.

THREE.

TWO.