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00:00:00,650 --> 00:00:06,830

>>NASA has developed a number of laser based systems to measure winds and aerosols in the

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00:00:06,830 --> 00:00:07,830

atmosphere.

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00:00:07,830 --> 00:00:12,460

One of them is called DAWN, the Doppler Aerosol Wind Lidar, which is pictured right next to

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00:00:12,460 --> 00:00:13,460

me here.

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00:00:13,460 --> 00:00:17,789

And another one is HALO, the High Altitude Lidar Observatory.

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00:00:17,789 --> 00:00:23,640

The instrument integration process on the DC-8 is very technically complex.

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00:00:23,640 --> 00:00:29,089

One has to ensure that the instruments are fitted appropriately into their viewing ports

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00:00:29,089 --> 00:00:32,189

and that they're very stable and anchored down to the aircraft.

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00:00:32,189 --> 00:00:37,440

And ensuring that all of the cabling and wiring that goes in to connecting the computers and

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00:00:37,440 --> 00:00:42,460

other equipment to the actual instrument itself is quite a process that involves a diverse

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00:00:42,460 --> 00:00:46,690

team of technicians and engineers to make happen.

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00:00:46,690 --> 00:00:52,850
This is personally my first flight on a NASA research aircraft, never before have we been

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00:00:52,850 --> 00:00:58,690
able to fly a system that can measure water vapor, winds, and aerosols all simultaneously

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00:00:58,690 --> 00:01:01,100
on the same aircraft.

15
00:01:01,120 --> 00:01:07,920
[Airplane taking off]

16
00:01:12,240 --> 00:01:18,470
>>One, two, three, four, five, six, seven, eight, nine, ten.

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00:01:18,470 --> 00:01:24,540
>>Here we have the Doppler Aerosol Wind Lidar, or DAWN, and as you can see here, we have

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00:01:24,540 --> 00:01:27,920
signals coming in from the laser beams that we're shooting.

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00:01:27,920 --> 00:01:33,150
We are taking about ten beams per second at multiple different angles.

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00:01:33,150 --> 00:01:37,640
As this laser pulse moves at the speed of light, hits particulates in the atmosphere,

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00:01:37,640 --> 00:01:43,270
or aerosols as we cause them, the movement of these particulates causes the light that

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00:01:43,270 --> 00:01:49,430

we shot out to shift a little bit in frequency,
we call that the doppler shift, and we take

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00:01:49,430 --> 00:01:54,170

that dopplar shift and we use it to compute
wind profiles through the atmosphere.

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00:01:54,170 --> 00:02:00,520

Back here we have the High Altitude Lidar
Observatory, or HALO.

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00:02:00,520 --> 00:02:06,869

And so HALO has two primary functions, it
measures aerosols and water vapor in the atmosphere.

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00:02:06,869 --> 00:02:12,939

So these two systems, DAWN and HALO, are again
shooting lasers and sort of coming up with

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00:02:12,939 --> 00:02:20,599

kind of a remote sensing estimate of what
the winds, water vapor, and aerosols are.

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00:02:20,599 --> 00:02:28,240

But this instrument right here, which is a
dropsonde system, so we take the dropsonde,

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00:02:28,240 --> 00:02:33,840

put it in this tube, pull this lever, and
it sucks it out of the plane.

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00:02:33,840 --> 00:02:40,240

From this data we come up with very very detailed
pictures of what the winds are and what the water

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00:02:40,240 --> 00:02:46,530

vapor temperatures are in the atmosphere that
we can use to validate these remote sensing

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00:02:46,530 --> 00:02:51,150
estimates of wind and water vapor from the
lasers.

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00:02:51,150 --> 00:02:55,010
Up until now, we only had a finite set of
measurements to understand what winds are

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00:02:55,010 --> 00:02:56,370
in the atmosphere.

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00:02:56,370 --> 00:02:59,909
We launch weather balloons, but those only
occur at fixed locations.

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00:02:59,909 --> 00:03:05,130
We use satellite data to track cloud and water
vapor features along in time, but only at

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00:03:05,130 --> 00:03:06,919
levels where those clouds are located.

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00:03:06,919 --> 00:03:12,629
One of the beauties of doppler wind lidar,
is that it allows you to measure winds in

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00:03:12,629 --> 00:03:17,569
what would otherwise be invisible conditions,
so cloud-free conditions.

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00:03:17,569 --> 00:03:22,599
We're doing this to understand how accurate
these instruments are and also to understand

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00:03:22,599 --> 00:03:26,110
how we might be able to take these instruments
to space someday.

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00:03:26,110 --> 00:03:32,489

With these laser instruments here, we're being able to collect very very detailed profiles

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00:03:32,489 --> 00:03:37,879

of water vapor, wind, and aerosols that can be used to put into weather forecast models