Talking to Space Shuttle Atlantis

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Contact the International Space Station!

You can live a similar experience as the one described below. A number of astronauts on board the ISS are licensed ham radio operators. You can contact them during their leisure time.

Calculate ISS flyovers for your location or track the ISS on a map.

Introduction

This is a summary of my 2m FM radio contact on Saturday, March 28, 1992 with astronaut and fellow radio amateur David C. Leestma, N5WQC, on board of spaceship Atlantis during shuttle mission STS-45. This was also the mission that carried Dirk Frimout, ON1AFD the first Belgian astronaut into space. At that time, I was an eighteen year old first-year undergraduate engineering student and I held the call sign ON1ASP. I was one of the only 48 Belgian hams fortunate enough to make a QSO with STS-45.

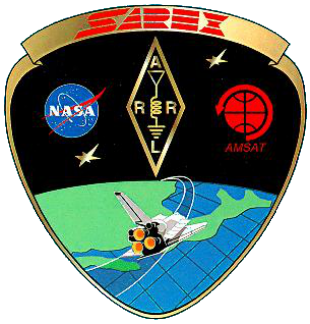
Recordings

Note: For the duration of the mission, all four ham-licensed astronauts shared David Leestma's call, N5WQC.

Table 1: Recordings

description	recording
Dirk Frimout, ON1AFD calling CQ.	[ogg][mp3]
Wilfried Suffis, ON7TH calls. Dirk Frimout, ON1AFD answers. Coincidentally, both are from Poperinge, Belgium.	[ogg][mp3]
Dirk Frimout, ON1AFD saying that he also studied at Ghent University.	[ogg][mp3]
Me calling with call sign ON1ASP. David Leestma, N5WQC confirms.	[ogg][mp3]
Kathyrn Sullivan, N5YYV coming back to an LM5-station.	[ogg][mp3]
Kathyrn Sullivan, N5YYV answering a call from Norwegian club station LA2AB.	[ogg][mp3]

Experiment



The SAREX patch

The Shuttle Amateur Radio Experiment (SAREX) was a long-running program to use amateur radio equipment on board NASA's Space Shuttle, the Russian Mir space station, and the International Space Station. It involved students in exchanging questions and answers with astronauts on orbit. More than 200 schools participated. It was also used to conduct communications experiments with amateur radio operators on the ground. Detailed information about SAREX can be found here. The SAREX experiment has been superseded by the Amateur Radio on the International Space Station (ARISS) program.

SAREX was designed to demonstrate the feasibility of amateur shortwave radio contacts between the Space Shuttle and ground amateur radio operators. SAREX also served as an educational opportunity for schools around the world to learn about space first hand by speaking directly to astronauts aboard the Shuttle via ham radio. Contacts with certain schools were included in planning the mission.

In addition, when the Russian Mir Space Station became visible to the STS-45 crew during the mission, SAREX was used to make a conversation with the Mir cosmonauts, who also had a ham radio aboard.

Four of the STS-45 crew members are licensed amateur radio operators: Mission Specialists Dave Leestma, call sign N5WQC; Kathy Sullivan, call sign N5YYV; Pilot Brian Duffy, call sign N5WQW; and Payload Specialist Dirk Frimout, call sign ON1AFD. Frimout and Sullivan are fluent in several European languages and made contacts in that part of the world. However, STS-45's 57-degree inclination placed the spacecraft in an orbit that allowed worldwide contact possibilities, including high latitude areas not normally on the Shuttle's groundtrack.

Ham operators could communicate with the Shuttle using VHF FM voice transmissions, a mode that made contact widely available without the purchase of more expensive equipment. The primary frequencies used during STS-45 were 145.55 MHz for transmissions from the spacecraft to the ground and 144.95 MHz for transmissions from the ground to the spacecraft.

SAREX was flown previously on Shuttle missions STS-9, STS-51F, STS-35 and STS-37. The equipment aboard Atlantis for STS-45 included a low-power, handheld FM transceiver, spare batteries, a headset, an antenna designed to fit in the Shuttle's window, an interface module and an equipment cabinet.

SAREX was a joint effort of NASA, the American Radio Relay League (ARRL), the Amateur Radio Satellite Corp. and the Johnson Space Center Amateur Radio Club. The Goddard Space Flight Center Amateur Radio Club will operated 24 hours a day during the mission, providing information on SAREX and retransmitting live Shuttle air-to-ground communications.

Table 2: STS-45 SAREX operating frequencies

location	shuttle TX (MHz)	shuttle RX (MHz)
U.S., Africa, South America and Asia	145.55	144.95
	145.55	144.97
	145.55	144.91
Europe	145.55	144.95
	145.55	144.75
	145.55	144.70

My equipment

- Four-element Tonna™ Yagi Uda antenna with vertical and horizontal polarisation
- TV antenna rotor without PC connection
- 33MHz Intel™ 80 486 DX PC for orbital tracking calculations
- Daiwa™ LA-2155H linear power amplifier
- Yaesu™ FT-290 2m all-mode transceiver
- 40A 13.8V linear power supply

Crew

Figure 1: STS-45 crew photo with, from left to right, in front: pilot Brian Duffy and commander Charles F. Bolden Jr.; backed by payload specialist Byron K. Lichtenberg, mission specialist C. Michael Foale, mission specialist David C. Leestma, payload commander Kathryn D. Sullivan and payload specialist Dirk D. Frimout. *Image credit: NASA*

Table 3: Crew

name	call	function	mission
Charles F. Bolden Jr.		Commander	3rd
Brian Duffy	N5WQW	Pilot	1st
Kathryn D. Sullivan	N5YYV	Payload Commander	3rd
David C. Leestma	N5WQC	Mission Specialist 2	3rd
C. Michael Foale		Mission Specialist 3	1st
Byron K. Lichtenberg		Payload Specialist 1	2nd
Dirk D. Frimout	ON1AFD	Payload Specialist 2	1st

Notable facts:

- Commander Charles F. Bolden Jr. went on to become the Administrator of NASA in 2009.
- Payload Commander Kathryn D. Sullivan went on to become the Acting NOAA Administrator in 2013.

- After his space flight, payload specialist Dirk D. Frimout was ennobled with the title of viscount in the Belgian nobility.

Hardware

- Orbiter Vehicle OV-104 Atlantis (11th flight)
- Solid Rocket Boosters (SRB): BI-049
- SRM: 360L/W021
- External Tank (ET): 44/LWT-37
- MLP : 1
- Space Shuttle Main Engine SSME-1: SN-2024
- Space Shuttle Main Engine SSME-2: SN-2012
- Space Shuttle Main Engine SSME-3: SN-2028

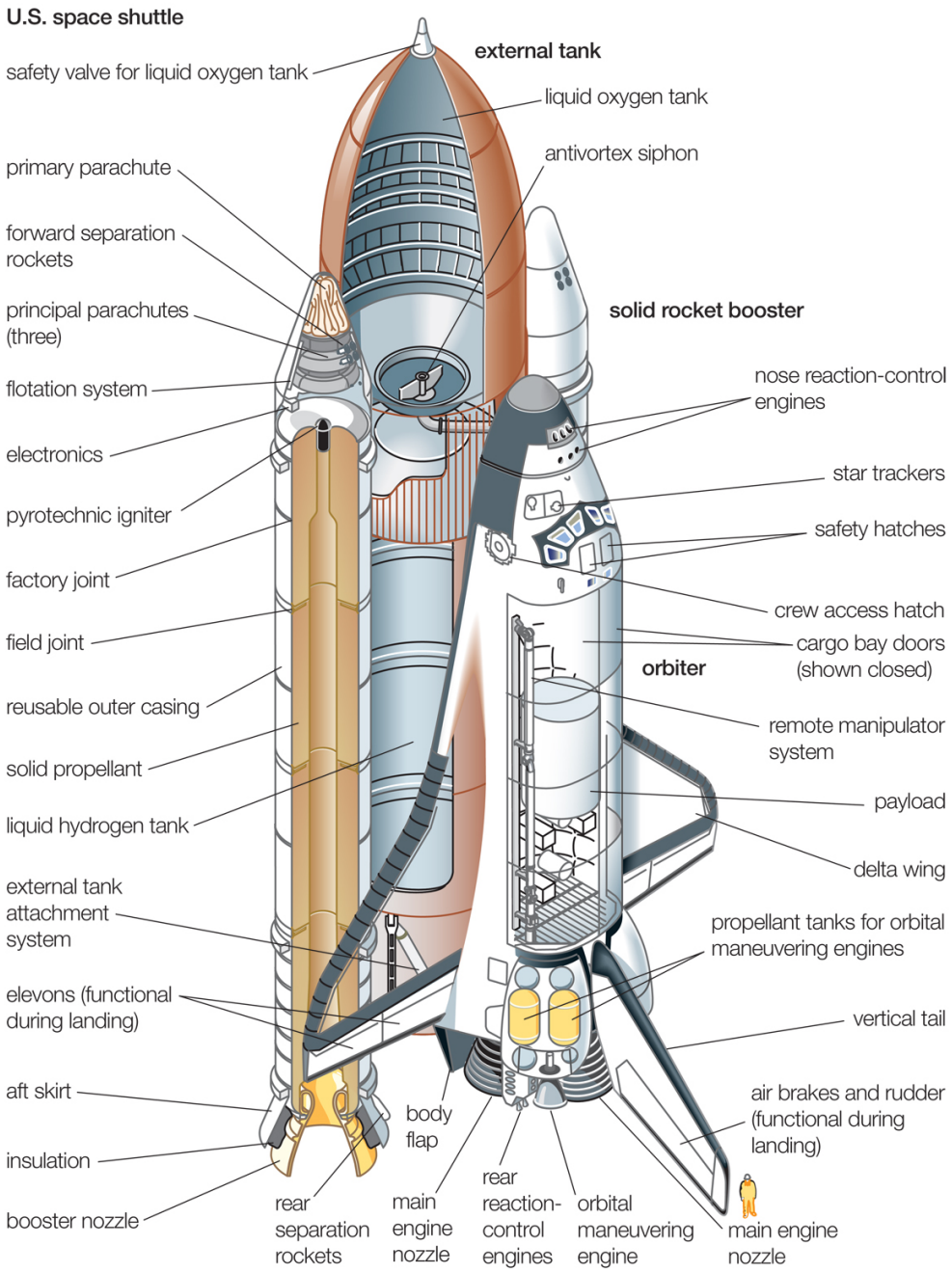


Figure 2: Space shuttle hardware

Launch

The launch was originally scheduled for March 23, 1992 but was delayed one day because of higher than allowable concentrations of liquid hydrogen and liquid oxygen in the orbiter's aft compartment during tanking operations. During troubleshooting, the leaks could not be reproduced, leading engineers to believe that they were the result of plumbing in the main propulsion system not thermally conditioned to the super cold propellants. The launch was eventually rescheduled for March 24.

- Space Transportation System STS-45 (46th space shuttle flight)
- Launch pad: 39-A (45th launch off this pad)
- Orbiter launch weight: 105 982 kg
- Launched: March 24, 1992, 8:13 a.m. EST

Table 4: STS-45 trajectory sequence of events

event	t (m:s)	$v_{rel.}$ (km/h)	mach	altitude (m)
Launch	00:00	0	0.00	
Begin roll maneuver	00:10	201	0.16	237
End roll maneuver	00:19	459	0.37	1 084
SSME throttle down to 89%	00:22	548	0.45	1 460
SSME throttle down to 67%	00:31	788	0.64	2 927
Maximal dynamic pressure (max Q)	00:56	1 365	1.11	9 321
SSME throttle up to 104%	01:06	1 688	1.38	12 907
SRB separation	02:05	4 544	3.71	47 270
Main engine cutoff (MECO)*	08:35	27 433	22.39	114 811
Zero thrust	08:41	27 431	22.39	114 882
ET separation	08:53			
Orbital Manoeuvring System OMS-2 burn†	37:08			

Table notes:
* Apogee & perigee at MECO: 291 × 35 km
† Apogee & perigee after OMS-2 burn: 298 × 296 km

Payload

Table 5: STS-45 vehicle and payload weights

description	mass (kg)
Orbiter (Atlantis) empty and 3 SSMEs	78 151
Cargo bay payloads	
Atmospheric Laboratory for Applications and Science-1 (ATLAS-1)	15 100
Shuttle Solar Backscatter Ultraviolet Instrument (SSBUV-4)	6 849
Get-Away Specials (GAS) Canisters & Support Equipment	237
Middeck payloads	
DSOs/DTOs	113
Space Tissue Loss (STL)	31
Shuttle Amateur Radio Experiment (SAREX)	14
Radiation Monitoring Experiment-III (RME-III)	10
Investigations into Polymer Membrane Processing (IPMP)	7.7
Visual Function Tester-II (VFT-II)	4.5
Cloud Logic to Optimize Use of Defense Systems (CLOUDS-1A)	2.3
Total Vehicle at SRB Ignition	**2 039 311**

Orbit

- Orbit altitude: 296 × 296 km
- Orbit inclination: 57.0 degrees
- Orbits: 143
- Duration: 8 days, 22 hours, 9 minutes 28 seconds.
- Distance travelled: 5 211 340 km

Mission

- Mission: Space Transportation System STS-45
- Primary Mission: ATLAS-1 spacelab mission - "On a mission to planet Earth"
- Press Kit
- STS-45 Image Archive

STS-45 crew patch

The mission carried the first Atmospheric Laboratory for Applications and Science (ATLAS-1) on Spacelab pallets mounted in the orbiter's cargo bay. The non-deployable payload, equipped with 12 instruments from the U.S., France, Germany, Belgium, Switzerland, the Netherlands and Japan, conducted studies in atmospheric chemistry, solar radiation, space plasma physics and ultraviolet astronomy.

ATLAS-1 instruments were:

- Atmospheric Trace Molecule Spectroscopy (ATMOS)
- Grille Spectrometer
- Millimeter Wave Atmospheric Sounder (MAS)
- Imaging Spectrometric Observatory (ISO)
- Atmospheric Lyman-Alpha Emissions (ALAE)
- Atmospheric Emissions Photometric Imager (AEPI)
- Space Experiments with Particle Accelerators (SEPAC)
- Active Cavity Radiometer (ACR)
- Measurement of Solar Constant (SOLCON)
- Solar Spectrum (SOLSPEC)
- Solar Ultraviolet Spectral Irradiance Monitor (SUSIM)
- Far Ultraviolet Space Telescope (FAUST).

Other payloads included Shuttle Solar Backscatter Ultraviolet (SSBUV) experiment, one get-away Special (GAS) experiment and six mid-deck experiments. The mission was extended by one day to continue science experiments.

Landing

Figure 3: STS-45 landing at Kennedy Space Center, Florida. *Image credit:* NASA

- Landing site: Kennedy Space Center, Florida
- Landing: April 2, 1992, 6:23 a.m. EST
- Orbiter landing weight: 93 005 kg
- Runway: 33
- Rollout distance: 2 812 m
- Rollout time: 60 seconds

QSL card

Some time after my contact, my mother told me we had received a white envelope with NASA letterhead. In it, was very nice QSL card, signed by Dave Leestma, N5WQC. Astronaut Dirk Frimout later also signed the card at a talk in Belgium.

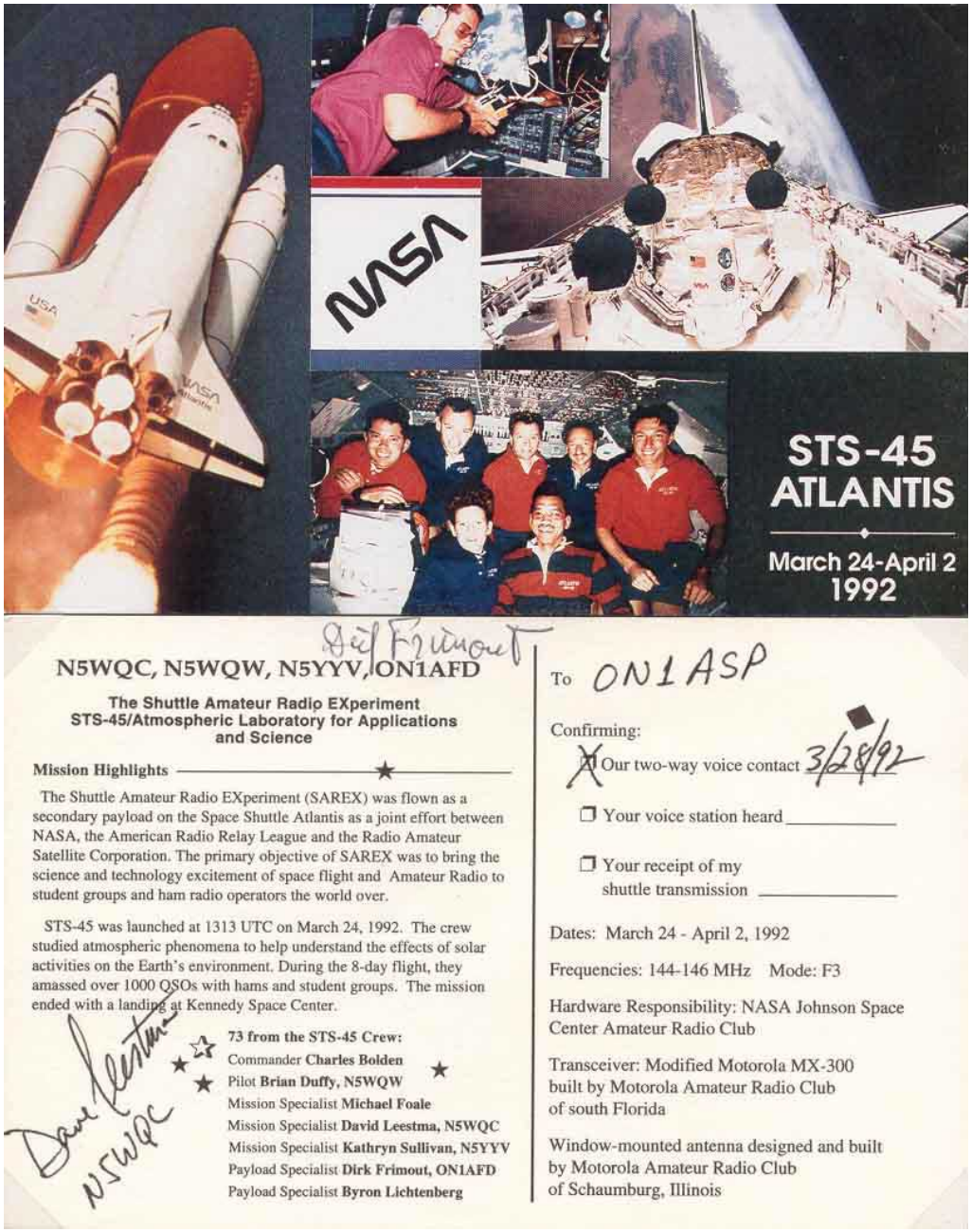


Figure 4: QSL card signed by Dave Leestma, N5WQC and Dirk Frimout

Frimout-mania

Prof. Calculus

Dirk Frimout's flight as Belgium's first astronaut made him instantaneously very famous in Belgium and triggered what was called Frimout-mania. Frimout's striking resemblance with the fictional character Professor Cuthbert Calculus of the also Belgian comics series The Adventures of Tintin, his goofiness and his high-pitched voice strengthened this frenzy. Philippe of Belgium also talked with Frimout during the mission and a ticker tape parade was organised when he came back to Belgium.

ARTlantis

Dirk Frimout's brother is a graphical artist. He made several drawings about his brother's space flight.

This work is published at https://hamwaves.com/atlantis/en/.

Last update: Monday, March 1, 2021.