

# Antipodes 2012

Between the 27th of April and the 1st of May a Mars analog field test was organized and coordinated by the Austrian Space Forum (OeWF) at the Giant Ice cave at the Dachstein Mountains, Upper Austria, Austria. During this test, the Aouda.X spacesuit simulator and selected geophysical and life-science related experiments were conducted.

The Antipodes experiment was a joint operations simulation between the OeWF (Austria), KiwiSpace (New Zealand) and the Mars Society (USA).

Antipodes is an operations experiment where a loss of communication (e.g. satellite is out-of-range) to Earth is simulated. A parallel landing party on the other side of Mars is requested to take over the coordination of an ongoing Extra-Vehicular Activity via their habitat, relayed via a satellite in Martian orbit until Earth is able to reestablish contact again.

Four distinct experiments were attempted to establish comms links using the relevant software, simulated rover control from Wellington, OeWF control of an MDRS experiment and MDRS control of an OeWF experiment.

## Experiment Team

The participants of this experiment were:

- The KiwiSpace crew at the Mars Desert Research Station (MDRS), Utah, USA
- KiwiSpace Mission Control Center (MCC Wellington), Carter Observatory, Wellington, New Zealand
- OeWF field team at the Dachstein caves, Upper Austria, Austria

Gernot Groemer	Haritina Mogosanu
Expedition Lead MARS2013 Austrian Space Forum	Commander KiwiMars 2012 KiwiSpace Foundation
<a href="http://www.owef.org">Contact Details</a> <a href="http://www.owef.org">www.owef.org</a>	<a href="http://www.kiwispace.org.nz/mars2012">Contact Details</a> <a href="http://www.kiwispace.org.nz/mars2012">www.kiwispace.org.nz/mars2012</a>

## Mission Teams

MARS2012	MDRS 118
	26Apr-05May
MSC key personnel	KiwiMars key personnel <ul style="list-style-type: none"><li>• Haritina Mogosanu, Mission Commander</li><li>• Elf Eldridge, Flight Director</li></ul>

## Schedule (Preliminary)

Date (Mars Time)	MSC Innsbruck	MDRS Utah	MCC Wellington

## Description of the experiments

---

Antipodes 0:

Antipodes 0 was conducted on Saturday, 28<sup>th</sup> of April and was also the first comcheck between the OPS at Dachstein and KiwiSpace. The video and audio worked very well. Due to probably a bandwidth problem the contact was lost during the ends of Antipodes 0.

Antipodes 2:

Antipodes 2 was supposed to be conducted on Sunday, 29<sup>th</sup> of April but did not happen as it was not possible to establish contact between the OPS at Dachstein and KiwiSpace.

Antipodes 1:

During this experiment which was operated on Monday, 30<sup>th</sup> of April MCC Wellington should have directed Aouda.X.

The streamed video had a good quality and a grid that was put over the streamed image was very helpful. Due to a low bandwidth the picture got a little bit blurry when the suit tester and therefore the helmet camera moved fast.

As a result of a communication problem directly before MCC Wellington was supposed to take over it was not clear to MCC Wellington what they were supposed to do exactly during this experiment and therefore it did not go as planned but many new valuable lessons were learned.

Antipodes 3:

This experiment was conducted on Tuesday, 1<sup>st</sup> of May and had the crew of KiwiSpace at the MDRS directing Aouda.X.

This experiment is considered a big success as everything did go as planned. MCC Wellington had all the information they needed beforehand and the voice communication was very clear. The video stream was fine as well even though it was blurry sometimes.

### Discussion

The communication problems were probably partly due to a low bandwidth and the fact that the OPS and KiwiSpace were communicating via two different servers on Mumble which caused some problems. Unfortunately this was only found out on Tuesday, the last day of the field test, but after the problem was known we were able to establish a solid communication.

Here a valuable lesson learned is that every experiment should be trained some days or even weeks before it's conducted. So any problems with bandwidth and communication can be detected before and can also be sorted out. With a test run also every participating party knows what to do and questions can be answered before the actual test. Also more than one communication system is needed so that if any problems should arise a quick switch to another system is possible. The hierarchy here should be Video – Audio- Text.

Also some kind of document with the intern structure and persons in command and also with their phone numbers would be very helpful.

Another important lesson learned would be that also the onsite crew needs the exact and detailed procedures for an experiment so that it can be conducted even when the communication system has broken down.

Therefore it would also be necessary that more actual scientists are in the field who actually know what they are doing during a science experiment from a scientific point of view.

Due to the many lessons learned during the Antipodes experiment but also because of the great and successful collaboration between the OeWF and KiwiSpace we should consider to continue with the Antipodes experiment during our next field missions.

### Acknowledgments

Information about the Software that was used was provided by Sebastian Sams.

All pictures were taken by Katja Zanella-Kux

ANTIPODES 1KiwiMars2012 = Comms - check

MSC Innsbruck	MDRS Utah	Field Morocco	MCC Wellington

- Having a broadband comm-check for everyone involved
- Verification of telemetry streams, lightning conditions, sound quality and verification of procedure versions and availability of experiment hardware
- The following connections are checked
  - Mission Control Wellington
  - MDRS

- MDRS spacesuits (they do not have to be on EVA, can also happen in the suit room)
- BASE (Morocco base station)
- Aouda.X
- Aouda.S
- In particular, the communication between the MDRS EVA suits and the Aouda-suits shall be verified. In this case, a verbal account of a current activities/status could be given by each crew member.



**Antipodes 1 experiment is now concluded.**

#### ANTIPODES 2Kiwimars2012 (MCC/W directs Aouda.X, MSC-Innsbruck is "offline")

MSC Innsbruck	MDRS Utah	Field Morocco	MCC Wellington

1. t -1 hrs: establishing contact between MCC Wellington, MSC-Innsbruck, BASE & Aouda.X - verifying broadband access, go ahead from both Flight Directors. Announcing who is the suit tester for this EVA.
2. t -0: Upon BASE "GO" suit commences experiment, MCC Wellington follows the procedures
3. t +10 min: loss of satellite signal, "no connection" between Aouda.X spacesuit and BASE, requesting hand-over
4. t +11 min: MCC/W gets full telemetry stream, has a few minutes to adjust and get ready: verify connection to SAFETY, BASE, MDRS
5. t +15 min: MCC/W takes over and continues experiment, e.g. sample site selection based upon video data
6. t +30 min: MCC/W concludes procedure, BASE resumes operation and continuous experiment.
7. t +45min experiment closure for MCC/W - opportunity for informal communication between all parties

BME @ BASE is monitoring at all times, OPS-lead, SAFETY and BME can interrupt and abort anytime.



**Antipodes 2 experiment did not take place/ cancelled due to connexion issues.**

#### ANTIPODES 3TasMars2013 (BASE directs MDRS-EVA)

MSC Innsbruck	MDRS Utah	Field Morocco	MCC Wellington
8 February 2013, 1800 hrs	<b>6 February 2013, 1000 hrs</b>	<b>6 February 2013, 1700 hrs</b>	<b>6 February 2013, 0600 hrs</b>

[Click here to see the Antipodes 3 Mission Log](#)

1. t -60 min: establishing contact between MCC Wellington, MDRS & BASE - verifying broadband access, go ahead from both Flight Directors. Announcing who is the suit tester for this EVA.
2. t -0: Upon MCC/W "GO", MDRS crews commences experiment, BASE follows the procedures
3. t +10 min: loss of satellite signal, "no connection" between MDRS and MCC/W, requesting hand-over to BASE by MDRS
4. t +11 min: BASE monitors MDRS crew, has a few minutes to adjust and get ready: verify connection to MDRS
5. t +15 min: BASE takes over and continues experiment, e.g. sample site selection based upon video data
6. t +30 min: BASE concludes procedure, MCC/W or MDRS Habcom resumes operation and continuous experiment.
7. t +45min experiment closure for BASE - opportunity for informal communication.

MCC/W monitors at all times and takes over if necessary.

[Click here for the procedures list](#) step by step instructions and material list.

#### TODO

- TasMars MDRS123 & EurogeoMars MDRS124: Define, which experiment will be conducted at MDRS for this;
- send procedures to MSC & BASE (contact: Alexander, cc: Roberta and Thomas &
- ask them to check it and relay that information to Morocco via satellite link.)



**Antipodes 3 experiment is now concluded.**

#### ANTIPODES 4TasMars2013 (MDRS or MCC directs Aouda.X) CLIFFBOT

MSC Innsbruck	MDRS Utah	Field Morocco	MCC Wellington
<b>6 February 2013, 1500 hrs</b>	<b>6 February 2013, 0700 hrs</b>	8 February 2013, 1400 hrs	9 February 2013, 0300 hrs

[Click here to see the Antipodes 4 Mission Log](#)

MDRS or MCC directs a CLIFBOTT experiment in [Morocco](#).

1. t -30 min: establishing contact between MCC Wellington, MDRS & Aouda.X & BASE - verifying broadband access, go ahead from both Flight Directors. Announcing who is the suit tester for this EVA.
2. t -0: Upon BASE "GO", the Morocco crew continues/commences geosampling experiment, MDRS follows the procedures
3. t +10 min: loss of satellite signal, "no connection" between Aouda.X and BASE, requesting hand-over to MDRS by Aouda.X
4. t +11 min: MDRS monitors Aouda.X, has a few minutes to adjust and get ready: verify connection to Aouda.X
5. t +15 min: MDRS takes over and continues experiment, e.g. sample site selection based upon video data from [mission.owef.org/telemetry](#)
6. t +30 min: MDRS concludes procedure, BASE resumes operation and continuous experiment.
7. t +45min experiment closure for MDRS - opportunity for informal communication. CONTACTS established connection to MDRS for a skype telecom to discuss the first impressions and lessons learned.



**Antipodes 4 experiment is now concluded.**

## Common Communication Basics

Used Software:

For the communication between the OPS, the suit as well as the field crew in the cave and KiwiSpace in Wellington and Utah the open source voice over IP software Mumble was used (Version: 1.2.2).

Video images of the helmet camera in the Aouda.X spacesuit were streamed via the VLC-Player.

To make all this possible nearly every part of the Giant Ice cave was provided with WLAN for the duration of the field test by OEWf team members.

The radio language for Mumble/Plumble radios is based upon on communication rules commonly used in air traffic and emergency services.

Call signs:

- MDRS-Station: MDRS-HABCOM
- EVA crew member @ MDRS: MDRS-ALPHA (BRAVO, CHARLY,... for additional analog astronauts?)
- Mission Control Wellington: CAPCOM-WELLINGTON
- Mission Support Innsbruck: CAPCOM-INNSBRUCK
- EVA crew member @ Morocco: "X-Ray" for AOUDA.X / "Sierra" for AOUDA.S
- Operator station at the Morocco field base: BASE

Common phrases used

- **"ACK"** = acknowledged (pronounced "Aye-See-Kay")
- **"Confirmed"** = indicated the called party has understood and agrees
- **"Affirmative"** = yes: received, understood and agreed
- **"Negative"** = No
- **"Copy"** = confirmation, that the message was received and understood, it does not imply, that the receiver agrees to it.
- **"Go ahead"** = send you transmission
- **"ETA"** = Estimated Time of Arrival
- **"Out"** = This is the end of a transmission and no answer is required or expected.
- **"Standby"** = wait a minute, I am busy but I will come back to you.

Common call signs

- **"BASE"** = on-site Operations
- **"Capcom"** = Capsule Communicator in MCC
- **"Flight"** = Flight director
- **"Safety"** = Safety officer on-site
- **"BME"** = Biomedical Engineer



### Emergencies Procedures

#### EMERGENCIES

Whenever there is an emergency situation (danger of significant damage or loss of life or equipment) in a PolAres setting, the safety officer, the suit tester, or the flight director may declare a **"CODE RED"**. This is **ONLY** to be used for real emergencies, **NEVER, EVER** use it jokingly in everyday language. This code is reserved for real trouble only. (If the team trains on simulated emergencies, the phrase **"CODE ORANGE"** is being used).

In such a case, any experiment is aborted, the local crew takes over and assess the situation and report as soon as possible back to THEIR MCC or OPS. FLIGHT decides further steps.