



Procedure ALIX

GENERAL INFORMATION

Principal Investigator	Christiaan Brinkerink	
Author(s)	Christiaan Brinkerink, Niels Vertegaal, Sam van den Ende, Daan Kapitein, Edward Sihol, Roel Kleinhans	
Version number	1	
Last edited on	16-02-2024	
Corresponding SEIF	File name	<i>SEIF ALIX</i>
	Version number	3
	Last edited on	16-02-2024

SHORT EXPERIMENT DESCRIPTION

On Mars, no satellite systems are available that would enable or facilitate navigation. Alternative methods of electronic navigation are therefore required. The Astronaut Location Interferometry eXperiment (ALIX) aims to perform (live) location tracking of astronauts or mobile platforms using a compact mobile radio transmitter, a set of reference beacons, and a small network of receiver stations.


EXPERIMENT RUN DESCRIPTION

The experiment runs aim to track the analog astronauts during E.V.A's, and possibly other vehicles if needed. The experiment is unpacked, and split in two. A transmitter is put in the habitat for the analog astronauts and GOST sets up the groundstations with the rest. After setup they deposit the central processing computer in the habitat as well which the AA's will use to track the transmitter they install on the suit.

HARDWARE CHECKLIST



Check	Name	Description (if needed)
<input type="checkbox"/>	5 receiver station electronics boxes	
<input type="checkbox"/>	10 coax cables (10m)	
<input type="checkbox"/>	10 tripods in sleeves	
<input type="checkbox"/>	10 wooden antenna clamps	
<input type="checkbox"/>	11 (10 for the receiver stations, one for the transmitter) monopole antennas	
<input type="checkbox"/>	5 extra power banks for charging	
<input type="checkbox"/>	5 power bank charging cables (USB - USB C)	
<input type="checkbox"/>	1 ethernet cable	
<input type="checkbox"/>	1 central processing computer (CPC) laptop	
<input type="checkbox"/>	1 CPC laptop charger	
<input type="checkbox"/>	1 transmitter electronics box	
<input type="checkbox"/>	30 burlap bags	




UNPACKING


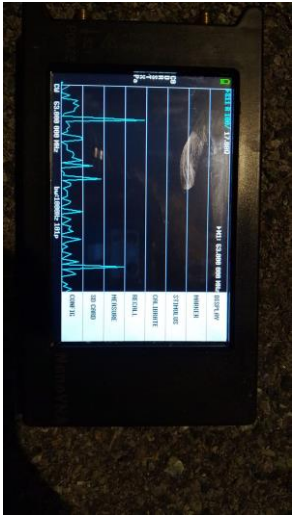
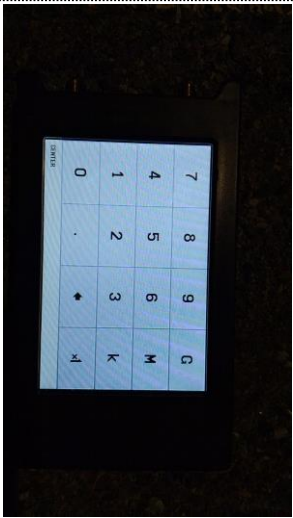
Step	Action	NOTES	Duration	Check
1	Unlock the black box.	use the white clamps on the lid	30 s	
2	Take out the CPC (laptop), laptop charger and ethernet cable.	This should go into the habitat	30 s	
4	Take out the red / white lint.	This is used for marking the receiver stations	2 min	
5	Take out 5 receiver station power banks with 5 usb - usb c charging cables.	Store these in a dry location where they can be easily accessed by GOST and charged.	3 min	
6	Take out everything else and sort it into 5 equal piles.	Each pile should consist of 1 receiver station electronics box, 2 coax cables, 2 tripods (in sleeves), two wooden antenna clamps, 2 monopole antennas	10 min	
7	Unlock the grey box.	use the white clamps on the lid	30 s	
8	Take out the 30 burlap bags and distribute them among the 5 piles made earlier	Each pile should have 6 bags (3 per tripod) and no power bank 	4 min	
9	Take out the remaining contents	This is for the transmitter, and should go to the habitat for mounting on the AA suit.	2 min	
Total	-	-	22.5 min	-


PREPARATION /ASSEMBLY (IN HABITAT)




[This section is divided into two parts. Part of the preparation is done in the habitat and the other part is done outside (by GOST). See next page for outside preparation.]


Step	Action	NOTES	Duration	Check
1	Connect the CPC laptop to its charger and plug the charger into an outlet. Connect the ethernet cable to the CPC laptop and to an ethernet port through which the CPC can connect to the polaris network.	A normal wall outlet can be used to plug in the charger.	2 min	
2	Open up the CPC laptop and power it on.	The power button can be found above the keyboard near the right side of the laptop	30 s	
3	Wait for the laptop to reach the user selection menu.		10 s (maybe, we never timed it)	
4	Press enter to select the ALIX user		1 s	
5	Fill in the password 'alix' and press enter to log in.		10 s	
6	Click the file explorer icon in the middle of the task bar on the bottom of the screen.	<p>You can click by quickly touching the touchpad.</p> <p>If no task bar is visible, pressing the super (windows) key should bring it up</p> 	10 s	
7	In the file explorer window, right-click on the executable called 'server'.	<p>You can right-click on the trackpad by quickly touching the touchpad with two fingers</p> 	10 s	

8	In the right-click menu, click the 'Run' option at the top. This will open a new window with the CPC GUI.		10 s	
9	Make the CPC GUI window full-screen by pressing the square button in the top-right of the window.	<p>Leave the CPC laptop open with this program running for the entire duration of the mission</p> 	10 s	
10	Take the transmitter box, unscrew the lid and open it.		2 min	
11	Disconnect all cables from the white pebble power bank and remove it		30 s	
12	Take out the black piece on top, revealing the nano vna.		10 s	
13	Disconnect the coax cable from the right port (port 1) of the nano vna		30 s	
14	Remove the nano vna		20 s	
15	Charge the nano vna and the power bank		6 h	

16	Turn on the nano vna using the switch on the top		10s	
17	Tap on the screen, a menu will appear.		10 s	
18	Tap on 'stimulus'		5 s	
19	Tap on 'center'		5 s	
20	Enter the correct frequency (63.0 Mhz) by tapping '6', '3', '.', '0' and then tap 'M' for Mhz		20 s	
21	Tap on the screen again and go to 'span' (if still in the stimulus mode, otherwise first tap 'stimulus')		10 s	
22	Enter '0'		10 s	
23	Tap on the screen and go to 'calibrate' (if you are still in the stimulus mode, first press back)		10 s	
24	Press 'reset'. The check at 'apply' should be gone.		10 s	
25	select calibrate		5 s	

26	Tap 'open'		5 s	
27	Tap 'load', wait for the blue bar at the top to finish, a check mark should appear.		20 s	
28	Tap 'short', wait for the blue bar at the top to finish, a check mark should appear.		20 s	
29	Tap 'isoln', wait for the blue bar at the top to finish, a check mark should appear.		20 s	
30	Tap 'through', wait for the blue bar at the top to finish, a check mark should appear.		20 s	
31	press 'done'		5 s	
32	press 'save'		5 s	
33	Turn the nano vna off, by switching the same switch used to turn it on.		5s	
34	Check if the frequency setting was saved successfully by turning the nano vna on and checking if the correct frequency is presented in the top right corner of the screen. If not: repeat from step 17. if successful, turn the nano vna off again		20s	
35	Put the nano vna with the screen down in the transmitter box.		10s	

36	Screw the coax cable from the amplifier to port 1 (the right port in the image) of the nano vna		20s
37	Put the black foam/ductape piece on top.		5s
38	Add the power bank to the left		5s

39	Put the short side of the lid on, and tighten the screws		30s	
40	Plug a usb cable into the input port of the power bank with the usb A side connected to nothing	It works, we dont know why, but it somehow makes sure the power bank doesnt turn off during use	10s	
41	close the lid for storage by screwing in the other two bolts		30s	
Total	-	-	13 min + 6h wait	-

PREPARATION /ASSEMBLY (AT A LOCATION CONVENIENT FOR GOST)



Charging the receiver station power banks:

Step	Action	NOTES	Duration	Check
1	Connect the 5 receiver station power banks to USB ports for charging using the USB - USB C charging cables.	The USB end of the charging cables can be connected to a USB port on a computer, phone charger etc.	5 min	
2	Leave the power bank to charge.	Leds on the side indicate how full it is.	10 hours	
3	Once the power banks are fully charged, disconnect them from the charging cable.		2 min	
Total	-	-	7 minutes - work, 10 hours passive	-

PREPARATION /ASSEMBLY (OUTSIDE)**[The DEM models are being used to determine suitable places for the receiver stations.]**

Receiver station deployment:

Step	Action	NOTES	Duration	Check
1	Gather all materials required to set up receiver station 1. This includes the receiver station electronics box labeled with a large black ducttape 1, 2 tripods, 6 burlap bags, 2 wooden antenna clamps, 2 monopole antennas and 2 coax cables and the red / white lint.	The receiver station power bank is not required yet.	5 min	
2	Take the 2 tripods out of their sleeves, fully extend their legs, and place them at the 2 crosses indicated on the map (location 1.1 and location 1.2). After placement, adjust the length of each leg if necessary to get the tripod to stand as vertical as possible.	Take some time to get the locations right.	5 min	
3	Fill the burlap bags with rocks. about 2 hand sized rocks would be ideal. Dont fill them too much as to not bend the tripod. Use your best judgement and common sense.		5 min	



4	Attach the burlap bags to the tripod midframes (3 bags per tripod, 1 per leg). Ensure the bags hang just above the surface.		5 min
5	Double check the tripod legs are not bent. If they are, reduce the weight in the bags.		5 min



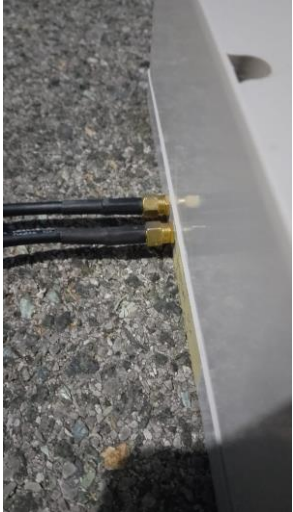
6


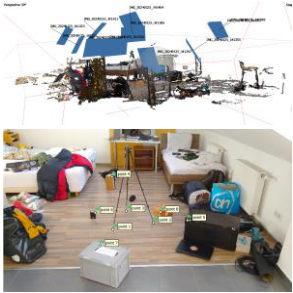
Screw the antenna clamps onto the tripods. Use the screw on the bottom (see second picture on the next page) to screw it on tight. Ensure to attach it such that the part of the clamp that contains the groove for the antenna sticks out over the green level that is part of the tripod.

5 min



7	Clamp the monopole antennas tightly in the wooden clamps. Try to match the second image the best you can.		5 min	
8	Extend the monopoles fully		1 min	
9	Use the rotation control on the tripod to ensure the monopole antennas are as vertical as possible. Take your time and use your best judgement.		5 min	


10	Screw the female ends of the coax cables into the monopole antennas.		2 min	
11	Roll out the coax cables. Do this as if you were rolling out a haspel to make sure the coax cable doesn't bend too much while rolling it out. Roll the cables out towards each other, such that they meet inbetween the tripods.		2 min	
12	Place the receiver station electronics box inbetween the tripods. Ensure the alix sticker is on the top.		1 min	
13	Attach the male ends of the coax cables to the receiver station electronics box. Ensure they are on as far as they will go. Write down which cable is screwed into which port.		5 min	

14	knot a bit of red-white ribbon to the tripod and wrap it few times around this section of the tripod (and knot it again to something after that so it won't blow away)		2 min	
15	Make a series of photo's (at least 20) all around the tripod, of the tripod and rocks around it, in different angles and orientations. (a phone camera will suffice).		5 min	
16	Check the approximate location of the tripod using the gps of a phone. Document this together with the photos from step 16.		2 min	
17	Repeat steps 1 to 16 for the other 4 receiver stations.		4 hours	
Total	-	-	5 hours	-

EXPERIMENT RUN PREPARATION

[These procedures are to be carried out on the day an E.V.A. takes place. This should be done as soon before the actual E.V.A. as possible.]



Step	Action	NOTES	Duration	Check
1	Gather the 5 charged power banks and a screwdriver to open the receiver station electronics boxes.		5 min	
2	Go to the location of the first receiver station.		T.B.D.	
3	Unscrew the two coax cables from the receiver station electronics box.		1 min	
4	Turn the receiver station electronics box upside down.		10 s	




5	Unscrew the screws in the base of the electronics box, and temporarily store the screws somewhere safely. Use your hand to keep pressure on the box, to compensate for the pressure removed by unscrewing the screws.	The power bank in the receiver station box remains in place with friction. Keeping pressure on the box prevents the power bank from moving around.	5 min	
6	While keeping pressure on the box, turn it right side up.		10 s	
7	Open the box.		10 s	
8	Take out the power bank.		10 s	
9	Put a charged power bank in its place, and connect it to the power cable. The receiver station will turn on automatically when the power bank is connected.		30 s	
10	Close the box (ensure the orientation of the lid is the same as when it was opened).		10 s	
11	While maintaining pressure on the box, turn in upside down. Keep applying pressure with your hand until the box is screwed shut.		10 s	
12	Screw the box shut.		5 min	
13	Turn the box right side up		10 s	
14	Screw the two coax cables into the receiver station electronics box. Ensure each cable is screwed into the same port as before.		1 min	
15	Repeat these steps for the other 4 receiver stations		1 hour	
16	Charge the 5 power banks that were just taken out of the receiver stations. Follow the procedures in the table 'Charging the receiver station power banks' found in the Preparation / Assembly section.		7 minutes work + 10 hours of charging.	


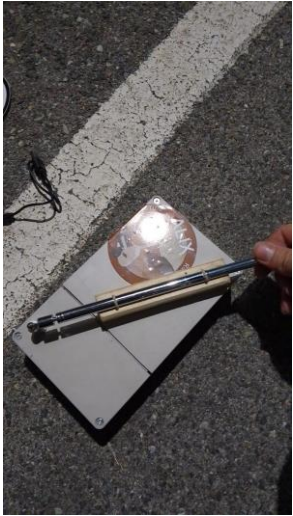
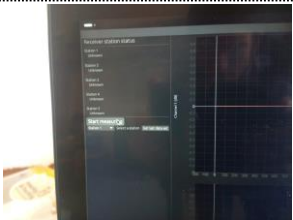
Total	-	-	~1h 21 min	-
-------	---	---	------------	---

EXPERIMENT RUN

[These experiment run procedures are for an E.V.A. where an AA inside the habitat will track an AA in a suit outside the habitat. Tracking of other things like rovers is also a possibility and procedures for that will be worked out once the demand for it has been established. However, for the AA’s inside the habitat the process will be very similar in both cases.]

Step	Action	NOTES	Duration	Check
4	Open the long side of the lid by unscrewing Turn off the transmitter on the AA's suit using the ON/OFF switch on the outside of the transmitter.the bolts.		1 min	
5	Plug the usb cable hanging from the amplifier into the output port of the power bank. The light of the amplifier should turn on.		20 s	

	<p>turn on the nano vna. The light near the switch should turn on.</p>		<p>20 s</p>	
	<p>put the cables from the power bank in the correct space</p>		<p>20 s</p>	
	<p>close the lid by tightening the two bolts again.</p>		<p>1 min</p>	

	make sure the antenna connector is tight on the lid		5 s	
	slide the antenna down and screw it on the connector		20 s	
	connect the transmitter box to the suit	the astronauts know this better then we do	TBD	
4	When the AA leaves the habitat, click the 'Start measuring' button in the GUI on the CPC laptop. Ensure the text on the button changes to 'Stop measuring'. If this is not the case, the button was not clicked properly. For each receiver station, write down its status as displayed in the GUI both before clicking the button and a few seconds after clicking the button.		1 min	
5	Fully extend the antenna when the astronaut is outside the habitat		30 sec	
	wait for 1 minute after extension of the antenna before continuing the EVA	Data gathered while the AA is standing still in a known location is useful for calibration.	1 min	
	perform the EVA		TBD	

	Before entering the habitat, wait for 1 minute.		1 min	
	fold the antenna		1 min	
6	When the AA reenters the habitat, click 'Stop measuring' on the GUI on the CPC laptop. Ensure the text on the button changed to 'Start measuring'. If not, the button was not clicked properly. Write down the status of each receiver station as displayed in the GUI both before and a few seconds after clicking the button.		1 min	
7	Turn off the transmitter on the AA's suit using the ON/OFF switch on the outside of the transmitter.		1 min	
	make sure that before the next EVA the procedures for charging the nano vna and power bank are followed as described in the habitat preparations section.			
Total	-		10 minutes + EVA duration	-

POST EXPERIMENT RUN

[These procedures are to be carried out on the day an E.V.A. takes place. This should be done as soon after the actual E.V.A. as possible.]

Step	Action	NOTES	Duration	Check
1	Gather a screwdriver to open the receiver station electronics boxes.		1 min	
2	Go to the location of the first receiver station.		T.B.D.	
3	Unscrew the two coax cables from the receiver station electronics box.		1 min	
4	Turn the receiver station electronics box upside down.		10 s	
5	Unscrew the screws in the base of the electronics box, and temporarily store the screws somewhere safely. Use your hand to keep pressure on the box, to compensate for the pressure removed by unscrewing the	The power bank in the receiver station box remains in place with friction. Keeping pressure on the box prevents the power bank from moving	5 min	

	screws.	around.		
6	While keeping pressure on the box, turn it right side up.		10 s	
7	Open the box.		10 s	
8	Detach the cable from the power bank in the receiver station box.		30 s	
9	Close the box (ensure the orientation of the lid is the same as when it was opened).		10 s	
10	While maintaining pressure on the box, turn in upside down. Keep applying pressure with your hand until the box is screwed shut.		10 s	
11	Screw the box shut.		5 min	
12	Turn the box right side up		10 s	
13	Screw the two coax cables into the receiver station electronics box. Ensure each cable is screwed into the same port as before.		1 min	
14	Repeat these steps for the other 4 receiver stations.		1 hour excluding travel time	
Total	-	-	~1h 15 min	-

DISASSEMBLY

[These procedures describe how do disassemble and pack all ALIX hardware after the campaign.]

Step	Action	NOTES	Duration	Check
1	Place the 5 power banks and their charging cables in the in the black box.	The black box should contain the 5 power banks with charging cables, 10 tripod sleeves and the role of red / white lint.	2 min	
2	Go to the location of the first receiver station with the black box and grey box.		T.B.D.	

3	Remove all red / white lint from the tripods. This can be disposed of.		5 min	
4	Detach both coax cables from the ports on the receiver station.		1 min	
5	Disconnect the coax cables from the monopole antennas.		2 min	
6	Roll up the coax cable.	Don't wind the cable up too tightly. Tight bends can harm the cable.	3 min	
7	Retract the monopole antennas	It is best to not push on the top (the antenna is rather fragile), but grab a segment lower down and push that downwards.	2 min	
8	Remove the monopole antennas from the clamps.		3 min	
9	Remove the antenna clamps from the tripods.		1 min	
10	Remove the burlap bags from the tripods and empty them.		6 min	
11	Fold up the tripods and put them back in their sleeves	The sleeves are in the black box.	2 min	
12	Take the electronics box, coax cables, tripods, antenna clamps and monopole antennas in the black box. Store the burlap bags in the grey box.		2 min	
13	Repeat steps 2 to 12 of these procedures for the other four receiver stations.		2 hours	
14	Go to the habitat		T.B.D.	
15	Close the 'server' program running on the CPC laptop by clicking the 'x' button in the top right of the window.		10 s	
16	Close the CPC laptop	Turning it off first is optional	10 s	
17	Disconnect the laptop charger from the laptop and from the power socket.		30 s	
18	Disconnect the ethernet cable from the ethernet socket and the laptop.		30 s	
19	Place the ethernet cable, laptop charger and laptop in the black		1 min	

	box.			
20	Place the transmitter electronics box in the grey box		1 min	
Total	-		2 h 30 min	-