THREOD

SYSTEMS

RVT

REMOTE VIDEO TERMINAL

USER MANUAL

Revision: 1.3

Document Number: 502-526-115850-01-13

This page was intentionally left blank

STATEMENT OF CONFIDENTIALITY AND NON-DISCLOSURE

This document contains proprietary and confidential information. All data submitted is provided in reliance upon its consent not to use or disclose any information contained herein except in the context of its business dealings with Threod Systems. The recipient of this document agrees to inform present and future employees of the organization who view or have access to its content of its confidential nature.

The recipient agrees to instruct each employee that they must not disclose any information concerning this document to others except to the extent that such matters are generally known to and are available for use by the public. The recipient also agrees not to duplicate or distribute or permit others to duplicate or distribute any material contained herein without Threod Systems OÜ express written consent.

Threod Systems retains all title, ownership and intellectual property rights to the material and trademarks contained herein, including all supporting documentation, files, marketing material and multimedia.

BY ACCEPTANCE OF THIS DOCUMENT, THE RECIPIENT AGREES TO BE BOUND BY THE AFOREMENTIONED STATEMENT.

This page was intentionally left blank

TABLE OF CONTENTS

RECORD OF REVISION

Revision No.	Content	Date
1.0	First release	03.11.2022
1.1	Corrected software protocol. Fixed major bugs. Implemented a new login screen and server IP saving capabilities. Made changes to Chapter 3.2.2. Changed figures 13 to 14 and 17 to 22. Added chapters 6.1 Creating a connection. Modified chapters from 6.2 through 6.3.	22.11.2022
1.2	Replaced google maps with mapsforge map motor featuring offline maps and night mode. Fixed multiple bugs (see changelog).	03.02.2023
1.3	Implemented ArcGIS maps by ESRI for offline satellite support. POI nudging. New log for displaying login and connectivity information. HTTPS traffic improvements. Server certificates are packaged into the application. POIs listed in dialog. Implemented chat channels and one-to-one messaging. New feature – send RVT location to server. Implemented gimbal feedback listening for Orca-130 A03.	30.03.2023

TABLE OF FIGURES

1 SAFETY

The following information, together with local site regulations should be studied by all personnel concerned with the operation or maintenance of the equipment to ensure awareness of potential hazards.

Switch off supplies before removing covers or disconnecting any RF cables, and before inspecting damaged cables or antennas.

Avoid standing in front of high gain antennas (such as a dish) and never look into the open end of a waveguide or cable where strong RF power may be present.

Users are strongly recommended to return any equipment that requires RF servicing to Threod Systems OÜ.

CAUTION	This system contains MOS devices. Electro-Static Discharge (ESD) precautions should be employed to prevent accidental damage. Never touch the pins of an open connector.

This page was intentionally left blank

2 WARNINGS, CAUTIONS AND NOTES

UAVs of any kind are dangerous and can cause serious injury. Please read, understand and follow the cautions and instructions.

Throughout the manual warnings and cautions are used to highlight various important procedures. They are defined as:

AN OPERATING PROCEDURE, INSPECTION, REPAIR OR MAINTENANCE PRACTICE, WHICH IF NOT CORRECTLY FOLLOWED, COULD RESULT IN PERSONAL INJURY, OR LOSS OF LIFE.

AN OPERATING PROCEDURE, INSPECTION, REPAIR OR MAINTENANCE PRACTICE, WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE OR DESTRUCTION OF EQUIPMENT.

An operating procedure, inspection, repair or maintenance condition, etc., which is deemed essential to highlight.

3 REMOTE VIDEO TERMINAL (RVT)

3.1 RVT SET

Figure 1: RVT set

#	Part #	Part Description	Qty
	115850	**RVT Set**	**1**
1	116529	Case with foams	1
2	115125	Silvus radio	1
3	110288	Omni Antenna, 2.5 dBi	2
4	115122	Battery	1 (2[1])
5	115121	USB adapter	1
6	117066	Cable - SC-BW-ETH-6	1
7	104528	Power adapter for battery charger	1
8	115120	Power adapter for USB	1
9	115119	Radio battery charger	1
10	115188	USB C to ethernet adapter	1
11	115112	Samsung S21 Ultra smartphone	1
12	115177	Phone case	1
13	115116	Phone carrier	1
14	115123	Cable - SC-PRICBL-MOD D1	1
15	117067	Radio pouch	1
16	116925	Radio adapter with bolts	1
17	115124	Wi-fi dongle	1
18	117684	USB-A/USB-C cable	1
19	117682	USB wall charging adapter	1
20	117689	User manual	1
21	105088	Packing list	1
1 – Optional second battery			

3.2 RVT PARTS

3.2.1 Rugged Case with Foams

The rugged case is impact resistant and waterproof with custom made foam protection for sensitive equipment.

Weight (full)	3.2 kg
Dimension (outer)	L: 464 mm W:366 mm H: 176 mm
Temp range	-30°C to 90°C
IP code	IP67

Figure 2: Rugged case with foams

3.2.2 Radio Module

The radio is a Silvus StreamCaster 4200 Enhanced Plus (SC4200EP) MIMO (Multiple input, multiple output) with a 20 km transmission range. It has two threaded RF antenna connectors, channel knob and three data connectors (PRI, PTT, AUX). RVT set uses PRI connector for cable setup or AUX connector for Wi-Fi setup.

CAUTION	Never turn the radio on without antennas connected!

Parameter	**Value**
Weight	1.35 kg
Dimensions	L:67 mm W:39 mm H: 102 mm
Input voltage	9-20 VDC
Power consumption	Up to 48 W (10W TX)
Output power	Up to 10 W (20W effective w/TX Beamforming)
Modulation	BPSK, QPSK, 16-QAM, 64-QAM
Channel Bandwidth	5, 10 & 20 MHz (1.25, 2.5 in development)
Encryption standard(s)	DES Standard, AES/GCM 256 Optional (FIPS 140-2), Suite B
Tuning Step Size	1kHz
Data Rates	Up to 100Mbps (Adaptive)
Error Correction	1/2, 2/3, 3/4, 5/6
Antenna Processing	Spatial Multiplexing, Space-Time Coding, TX Eigen Beamforming, RX Eigen Beam Forming
No. of Spatial Streams	1-2
Latency	7ms Average
Sensitivity	-99 dBm @ 5MHz BW
Frequency Bands	Bands from 400MHz to 6GHz Available Dual Band Optional

CAUTION	Always keep the connector covers on when the radio is not being used.

1. RF Channels 1-2 Connectors [TNC Female]
2. Power Switch [15-Position Rotating]
3. Power (EB Version Only, 9-20V), Ethernet, and Serial Port Connector [ODU GK0YAR-P10UC00-000L]
4. Bi-Color Status LED:
    - **Red** – Radio is in the process of booting up.
    - **Flashing Green** – Radio is fully booted but not wirelessly connected to any other radio.
    - **Green** – Radio is wirelessly connected to at least one other radio.
    - **Flashing Red** – Spectrum Scan in Progress.
    - **Flashing Red** – Radio has recovered from a bad state.
    - **Rapid Flashing Red for 1 second** – The battery is less than or equal to 20%. LED will blink red rapidly for 1 second then go back to normal. This will repeat every 5 seconds.
    - **Rapid Flashing Green** – When the multi position switch is rotate to a new position, LED will rapidly flash green while new settings are being applied. LED will resume normal indication after settings have been applied.
5. Push-to-Talk (PTT) Connector [ODU GKCWAM-P07UB00-000L]
6. AUX Connector [ODU GK0YCR-P10UC00-000L] – Used with Wi-Fi dongle.

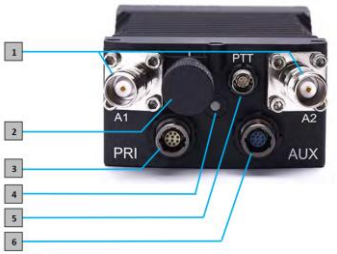


Figure 3: Radio module hardware overview

CAUTION	Selecting channel "z" erases all data from the radio that can only be restored by Threod Systems technician.

3.2.3 Battery

The battery BT-70716 is a Li-ion rugged battery designed for Silvus Streamcaster radios. It is installed by twist motion and can be removed by pressing the remove button and twisting the battery in the opposite direction. The Battery is charged by a special double charger provided with the set.

Parameter	Value
Weight	0.34 kg
Dimension	L:71 mm W:41 mm H: 86 mm
Capacity	6.8 Ah
Voltage	10.8V (Max 12.6V)
Discharge	6A Max Continuous
Operating Temperature	-30°C to +60°C
Storage Temperature	-40°C to +40°C

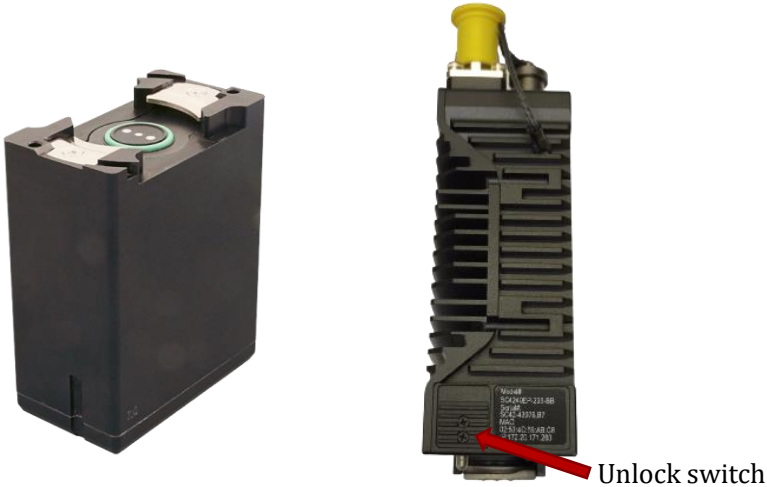


Figure 4: Battery and battery unlocking mechanism

3.2.4 Battery Charger

The battery charger is intended to charge two radio batteries simultaneously. The battery level can be seen on the indicator on the charger.

Parameter	Value
Weight	0.68 kg
Dimensions	L:89 mm W:140 mm H:60 mm
Input	AC 100 to 240 V
Output	DC 10V-32V, Max 60W

Figure 5: Radio's battery charger

3.2.5 Omni-directional antennas

The radio module uses two dual band omni-directional antennas. The antennas use RF threaded connectors which can be screwed onto the radio. The antennas have a flexible "gooseneck" structure for protection against damage from bending.

Parameter	Value
Weight	2x 63 g
Dimensions	L:200 mm D:14.3 mm
Frequency range	2.1-2.5 & 4.4-5.9 GHz
Peak gain	2.1 dBi/2.5 dBi
Power handling	50W each

Figure 6: Omni-directional antennas

CAUTION	Always align the antennas and connectors carefully not to damage threads and pins.

3.2.6 Wi-Fi dongle

The Wi-fi dongle is used to connect the radio to the Smartphone via a wi-fi connection. The dongle connects to the AUX connector on radio and thereafter creates a Wi-Fi network called “RVT_X.X”. The user connects the smartphone to this Wi-Fi network, and the data link is established. The network key is provided to the user with the set. Align the red dots on the dongle and the radio for correct insertion and good connection.

Figure 7: Wi-Fi Dongle

3.2.7 Cable SC-PRICBL-MOD D1

Cable SC-PRICBL-MOD D1 connects the radio to the ethernet cable SC-BW-ETH-6.

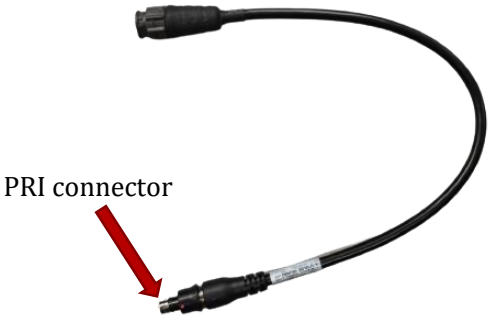


Figure 8: Cable SC-PRICBL-MOD D1

3.2.8 Cable SC-BW-ETH-6

Cable SC-BW-ETH-6 connects the cable SC-PRICBL-MOD D1 to the Ethernet-to-USB adapter or directly into the configuration device (PC) ethernet port.

Figure 9: Cable SC-BW-ETH-6

3.2.9 Ethernet to USB-C Adapter

The Ethernet to USB-C adapter is used to connect the cable SC-BW-ETH-6 to the Smartphone. The ethernet/RJ45 connector plugs into the ethernet port on the adapter and the USB-C side plugs into the USB-C port on the smartphone. The adapter provides the possibility to charge the phone while using the adapter. For charging, connect the USB-C charging cable to the USB-C input on the adapter.

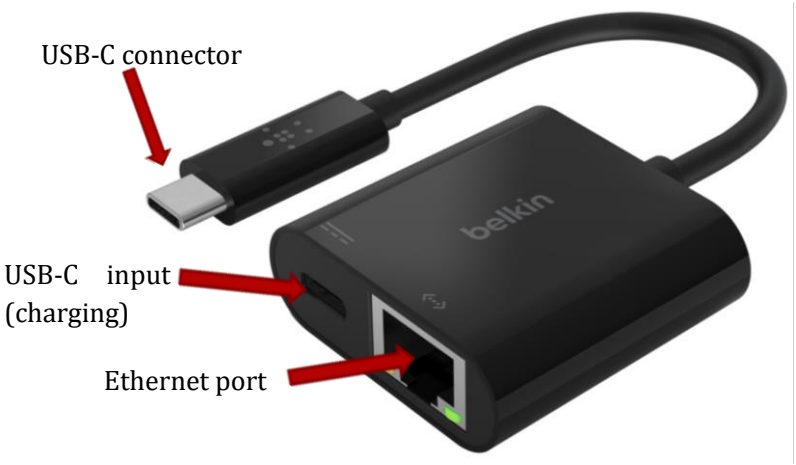


Figure 10: Ethernet to USB-C adapter

3.2.10 USB charger adapter and cable

The USB charger adapter is used to charge the smartphone through a USB cable. The adapter connects directly to the radio's battery. In addition, there is a 12V DC adapter which can be used to charge the battery. The adapter has two 5V USB outlets (3.5A max) and a battery level indicator.

Figure 11: USB charging adapter

3.2.11 USB wall charger

The set includes a standard fast charger (18W/3A) wall adapter with USB-A output and a USB-A to USB-C charging cable. The charger and cable are used to charge the phone through an ethernet-USB-c adapter or for charging the phone separately from other accessories.

Figure 12: Wall adapter with USB-A to USB-C cable

3.2.12 Samsung S21 Ultra

The Samsung smartphone is used as a remote video terminal to receive video/data link from the UAS and to communicate with the GCS. The Smartphone has a preprogrammed RVT app and VPN app installed. If the SIM card is installed and the network is available, it is possible to connect to the datacenter (which is synced with GCS) without using the radio. The Smartphone can be charged with the USB cable by using the USB charge adapter or the wall charger. The software user interface instructions are described in Chapter 6. SIM card insertion tool can be found in a zip lock bag beneath the tripod adapter in the case.

Figure 13: Samsung S21 Ultra

3.2.13 Armored case and plate carrier

The Smartphone is placed into a rugged case for additional protection. The phone can be removed from the case by removing the rubber case retainer. The rugged case mounts onto the plate carrier adapter with pressure. The plate carrier is installed onto the standardized plate carrier with three steps:

1) Place the lower tabs between the straps.
2) Place the top tabs between the straps. This requires bending the plastic.
3) Place the carrier retainer to the center as shown in the picture below.

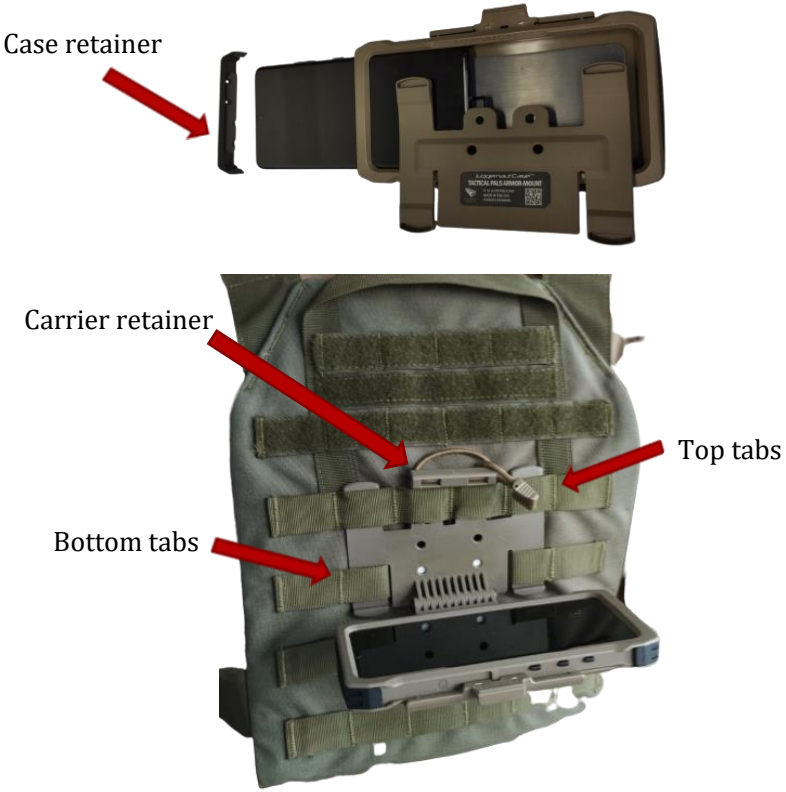


Figure 14: Case and plate carrier installation

3.2.14 Radio pouch

The pouch for the radio is designed to be mounted on standardized military clothing and meant for mobile use of the RVT.

Figure 15: Radio pouch

3.2.15 Tripod adapter

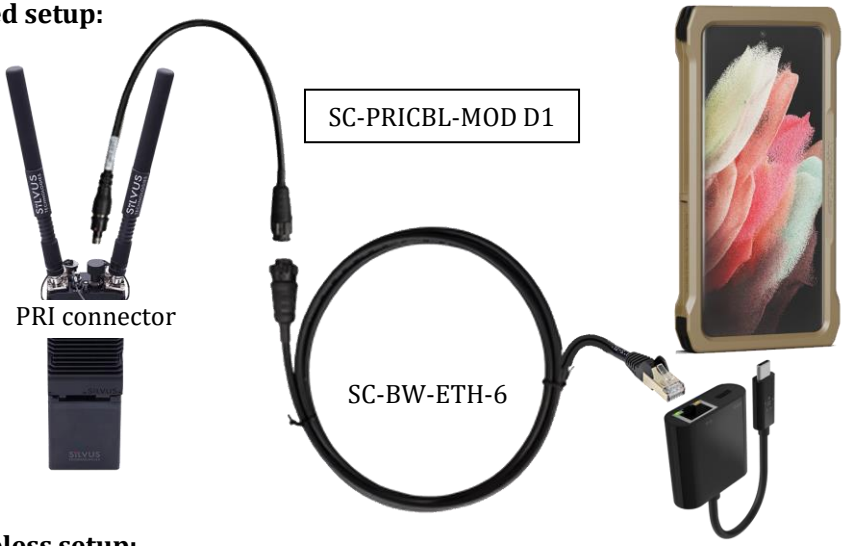
The tripod adapter gives a possibility to mount the radio onto a tripod that comes with the Ground Data Terminal (GDT) set (if purchased). The adapter can be mounted onto the radio using four bolts. Thereafter the adapter can be mounted onto the tripod with a click-on mechanism. The radio should always be mounted in a vertical position. Bolts are placed in a zip lock bag beneath the adapter.

Figure 16: Tripod installation

4 RVT ASSEMBLY

4.1 SETUP SCHEMATICS

Wired setup:



Wireless setup:

Wi-Fi dongle to
AUX connector

Application mode when using either of the setup options showed on this page (wired or wireless):

Serverless:
Live video link and gimbal controls – Link to aircraft

Server – Direct:
Live video link and gimbal controls – Link to GCS network (for communication - e.g. voice chat).

Figure 17: Setup schematics

4.2 ASSEMBLY INSTRUCTIONS

Wired setup:

1	Install both antennas. (Radio may never be turned on without antennas).	
2	Install battery with a twist/rotate motion.	
3	Connect SC-PRICBL-MOD D1 and SC-BW-ETH-6 cables. There is no incorrect way to connect the cables.	
4	Connect open end of SC-PRICBL-MOD D1 cable to radio's PRI connector.	
5	Connect open end of SC-BW-ETH-6 cable to ethernet-to-USB-C adapter.	
6	Connect USB-C cable to smartphone USB-C port.	
7	Turn on the radio by pulling out, then twisting the Multi-Position Switch to position nr 1. Wait for green LED to start blinking.	
8	Open "ThreodRVT" app.	
9	Choose "**Serverless**" or "**Server-Direct**" option based on whether GCS (operator server) network is available.	
10	Follow the user instructions available in Chapter 6.	

Wireless setup:

1	Install the antennas. (Radio may never be turned on without antennas).	
2	Install the battery with a twist/rotate motion.	
3	Connect wi-fi dongle to AUX connector on radio.	
4	Turn on the radio by pulling out, then twisting the Multi-Position Switch to desired position. Most common preprogrammed channel is 1. Other channels are programmed to be used with specific aircrafts (Network ID already linked to aircraft, see Chapter 6.1.2 – step 6. Configure MPS). Wait for green LED to start blinking.	
6	Open smartphone and connect to SSID: “RVT_X.X” Wi-Fi network with the password being <Radio IP address>.	
7	Open “ThreodRVT” app.	
8	Choose “**Serverless**” or “**Server-Direct**” option based on whether GCS (operator server) network is available.	
9	Follow the user instructions available in Chapter 6.	

Smartphone only (VPN) setup:

1	Open smartphone and connect to VPN to get access to datacenter servers (Chapter 6.1).	
2	Open “ThreodRVT” app.	
3	Choose “**Server-Datacenter”** option from the app.	
4	Follow the user instructions available in Chapter 6.	

5 DISASSEMBLY

CAUTION	Before disassembling, power off the battery as it may damage the equipment.

Disassemble the unit in the reverse order. Before packing check that the cables are without any damage and the connectors are clean.

6 USER INTERFACE

6.1 CREATING A CONNECTION

6.1.1 Connecting to SILVUS StreamCaster

- If setup wirelessly:
  - Connect smartphone to SILVUS radio Wi-Fi:
    - Network SSID: **RVT_<Radio IP last two values>**
    - Network password: **<Radio IP address>**
- If setup wired:
  - Skip to next step.
- User can configure the radio with a laptop/PC as well. The computer needs to be connected to the radio via the provided adapter (SC-PRICBL-MOD D1 + SC-BW-ETH-6 – see figure 18 for reference) or via Wi-Fi.

Figure 18: Configuring Silvus connection - PC

6.1.2 Configuring SILVUS StreamCaster

1. Turn on the radio by pulling out, then twisting the knob to position “1”. Users can type “ping <IP address>” in a command line to determine whether the radio is fully booted.

Figure 19: Radio Multi-Position Switch

- <IP address> label is printed on the radio.

Figure 20: Radio IP address label

2. A web configuration will then be available through StreamScape by typing the radio IP address in a web browser.
   - Please ensure that your smartphone/PC connection is on the same subnet as the radio (172.20.X.X by default).

Troubleshooting on windows:

- Wired connection:
  - Open control panel -> Network connections.
  - Right click on the connection used and select properties.
  - Open the Internet Protocol Version 4 (TCP/IPv4) properties.
  - Assign IP address: 172.20.X.X.

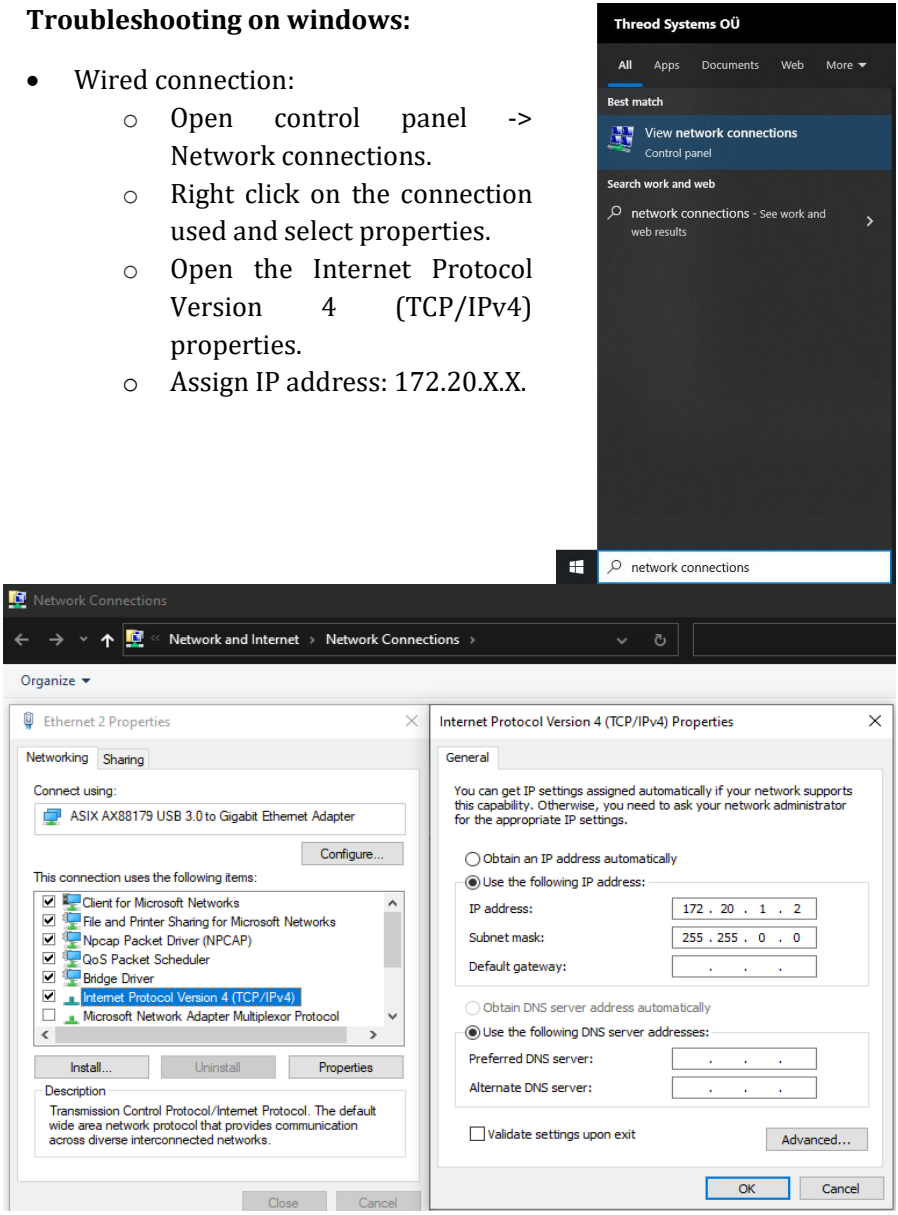


Figure 21: Control panel - network connections - TCP/IPv4 properties.

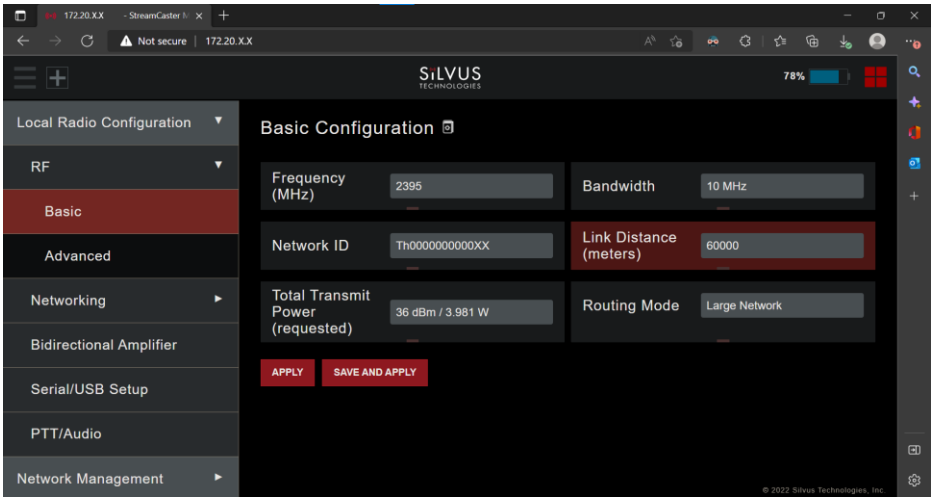


Figure 22: StreamScape – Basic configuration

This page is used to set basic configurations. A brief description of each parameter is given below.

- Frequency: This defines the frequency of the signal. There is a drop-down menu for frequency selection. The frequency choices will vary depending on the StreamCaster model(s) you are using. In the additional information section of the frequency section (click on the red bar directly below), you can select a link that will take you to create custom frequencies.
- Bandwidth: This defines the RF bandwidth of the signal. A higher bandwidth will allow more throughput while a narrower bandwidth will be susceptible to less noise.
- Network ID: Allows for clusters of radios to operate in the same channel but remain independent. A radio with a given Network ID will only communicate with other radios with the same Network ID.

- Link Distance: Set to an approximate maximum distance between any two nodes in meters, e.g. 60000 for 60 km (default). It is important to set the link distance to allow enough time for packets to propagate over the air. Failing to set the link distance to an approximate maximum distance can result in over the air collisions and a degradation of performance. It is recommended to set the link distance 10-15% greater than the actual maximum distance. **Please note that this value should be set the same on all radios in the network.**
- Total Transmit Power: This defines the total power of the signal (power is divided equally between the radio antenna ports). There is also an option to 'Enable Max Power' which will allow the radio to push to the highest TX power it can support. This will be slightly different on each radio.
- Apply: Apply the new values. Values will change back to the default setting after reboot.
- Save and Apply: Apply the new values and set the new values as the default.

3. Users will initially see the link distance warning, then be directed to the Local Radio Configuration page.

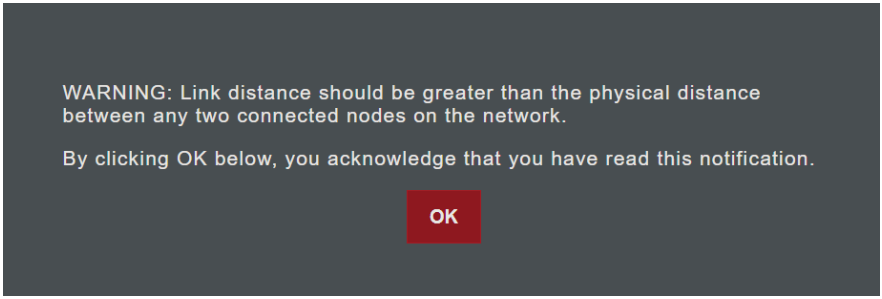


Figure 23: StreamScape - Link distance warning

4. You will be able to navigate to various configuration pages from the drop-down menu on the left-hand side. On the right, you can open additional details about the radio by selecting the four-square icon on the top right of the screen. Throughout the user interface, if there is a red bar below the parameter you will be able to click on it for either additional notes about the parameter or see additional options.

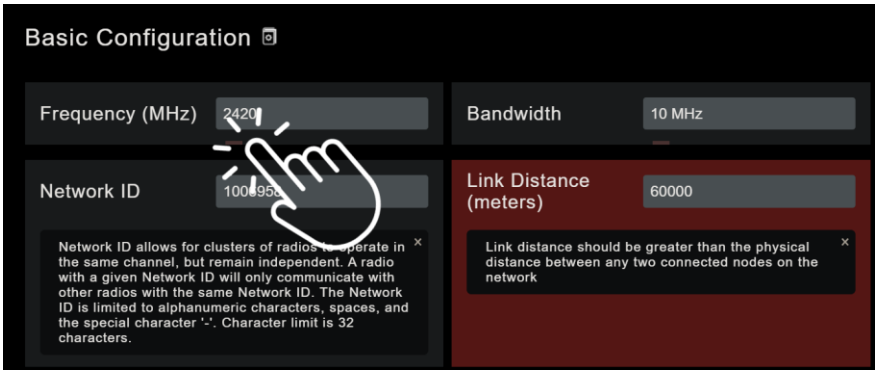
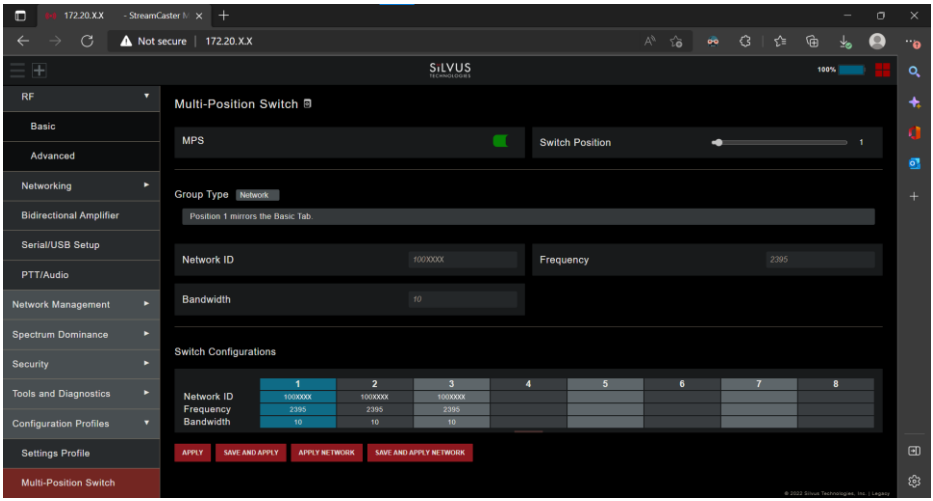


Figure 24: StreamScape - Additional notes - red bar

5. Set the Network ID to match the aircrafts serial number.
   - Find the serial number label on top of the EOS C avionics module:
     - S/N: 100XXXX

Figure 25: EOS C serial number label



6. Configure MPS (Multi-Position Switch)

- The Multi-Position Switch allows you to change various settings of the radio by using the new physical switch position, no web GUI required. You must first configure the settings you want to correspond with each switch position.
- The “Switch Position” slider represents which position is currently being edited.
- “Group Type” represents the collection of settings that will be applied. Only one “Group Type” is active at a given time.
- When the MPS switch is turned, the LED light on the radio will quickly flash green. This means the settings are being applied for this position. When the LED stops quickly flashing, the settings have been applied. Position 1 is special. Any time settings are updated from the GUI without using the MPS page (i.e. Basic Tab, PTT/Audio Tab), position 1 will be updated with those results. The green highlight shows the current position of the physical switch. If the radio boots up in position “Z”, MPS will be disabled until the radio is rebooted in another position.

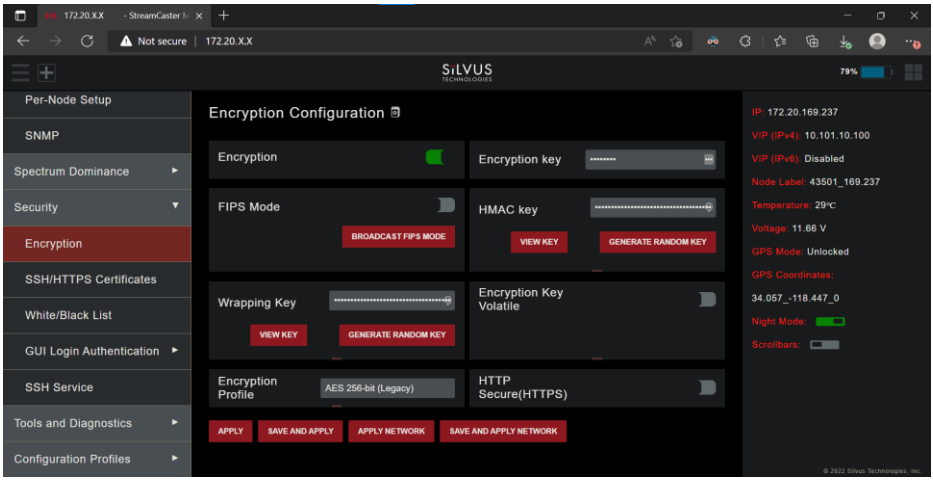


Figure 26: StreamScape - Security - Encryption

7. Optional: Changing the encryption key.

   The Security section of StreamScape allows users to enable/disable encryption, upgrade radios, and load license files for enabling features such as AES encryption.

   - Encryption: Enable or disable encryption.
   - Encryption Key: Set an encryption key if encryption is enabled.
   - Encryption Profile:
     - AES 256–AES encryption using 256-bit keys. This mode is backwards compatible with legacy SC3500/3800 radios.

6.2 CONNECTING TO VPN

This section will explain how to create a connection between the smartphone and the datacenter (SERVER – DATACENTER).

1. VPN connection is required to get access to datacenter server.
   OpenVPN is used as a VPN service.
   System administrator will create an OpenVPN profile file which is preinstalled on the Samsung smartphone.
2. Open OpenVPN for Android app and import profile **file**.
3. Make sure the profile name is set to “vpn0”.
4. On first connection, enter profile username and password, check ‘Save password’.

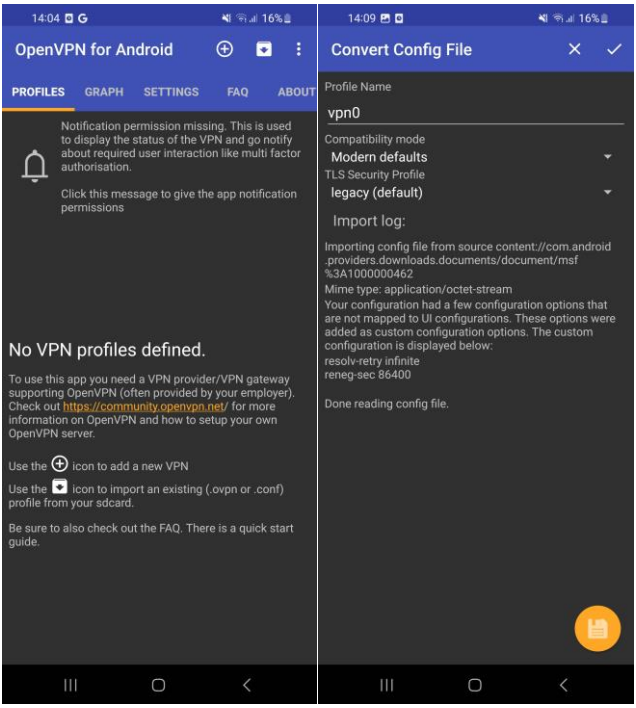


Figure 27: OpenVPN profile loading

6.3 APP USER INTERFACE (UI)

Open "**ThreodRVT**" app. Three modes are available on the home screen:

a) **Serverless:** Live video link and gimbal controls – Needs access to aircraft via Silvus radio network.
b) **Server – Direct:** Live video link and gimbal controls – Needs access to GCS network via Silvus radio (for communication).
c) **Server – Datacenter:** Live video link, playback, communication, Needs access to datacenter network via LTE/5G over VPN.

Application mode:	a	b	c
Live video link	x	x	x
Gimbal controls	x	x	*
Voice/Chat		x	x
Server synced POI (Point of Interest)		x	x
Missions list/archive			x
Playback of recorded missions			x

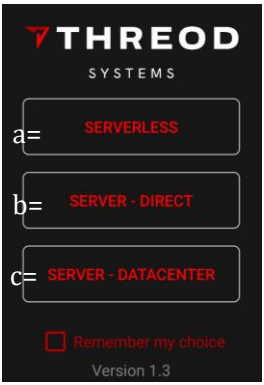


Figure 28: ThreodRVT main screen - mode options

- Checking "Remember my choice" will skip this (main screen) dialog and launch the chosen mode on next app start.
    - Remembered choice is reset on Connection Settings – Logout button click. Exiting the app will not reset the choice.
- Clicking on version number text opens the changelog.

* In development

6.3.1 Servered login

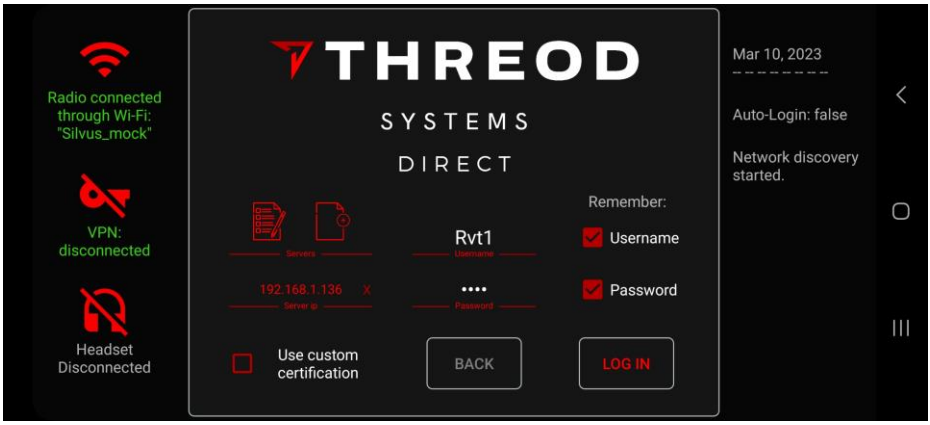


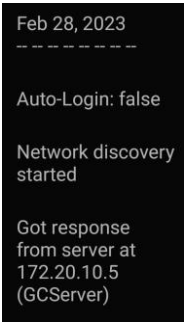
Figure 29: Direct mode/Datacenter mode login UI

- Internet – Displays connectivity status.
  - Action: open internet connectivity panel.

- VPN – Displays virtual private network connectivity.
  - Action: connect (Datacenter) / disconnect (Direct) from OpenVPN client.

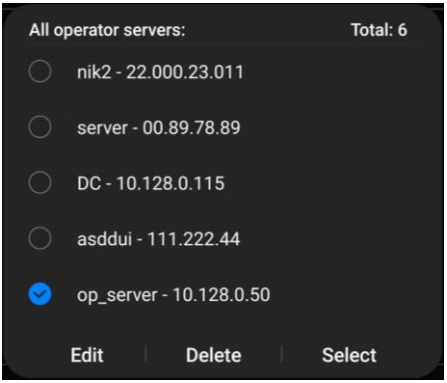
- Headset – Displays headset connectivity.

- Log – Displays information about login actions.
  - Some log entries are clickable, providing more actions. For example: clicking on "Auto-Login" log entry opens a dialog for enabling/disabling Auto-Login.
  - If using the correct network, RVT uses network discovery to resolve operator server IP address. Upon getting a successful response the login button text color will be set to green.



- All servers – Displays a dialog with all saved servers.
  - Options: edit, delete, select server.

- Add server – Displays a dialog for manually adding a new server.



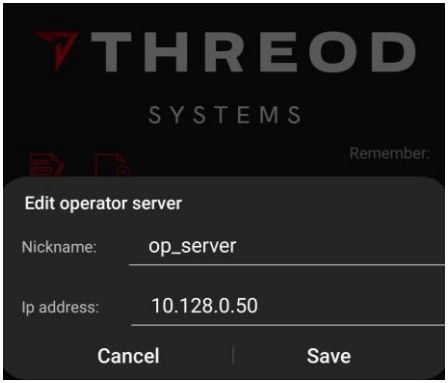
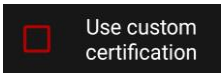


Figure 30: Direct mode/Datacenter mode saved servers dialog

- The application has default certificate and key packaged and ready to be used out-of-the-box. The use of custom certificate and key file can be enabled by checking the following option.

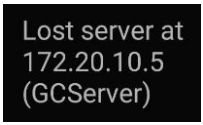


  - Certification - Choose file (*.crt) from storage.

  - Key - Choose file (*.key) from storage.

6.3.2 Troubleshooting

- If you see a message: "Login failed! Server address or network not found! Error: 0":
    - Check VPN connection.
- If login timeout or stuck on connecting:
    - Force close app and re-open.
- The following log entry indicates that the connection to the found operator server is lost. This usually happens when the network changes.
    - Make sure the operator server and RVT are on the same network.



6.3.3 Internet connectivity

We recommend using the device with a SIM-card installed for online maps using mobile data.

Because all other traffic (video feed, server requests, gimbal controls etc.) will be routed over Wi-Fi/Ethernet interface. To use mobile data for online maps in Serverless and Server-Direct mode ThreodRVT must be added to the Mobile Data only apps list in android settings -> Connections -> Data usage -> Allowed network for apps -> Set ThreodRVT to use "Mobile data only". This will allow android to use two network interfaces simultaneously for the app.

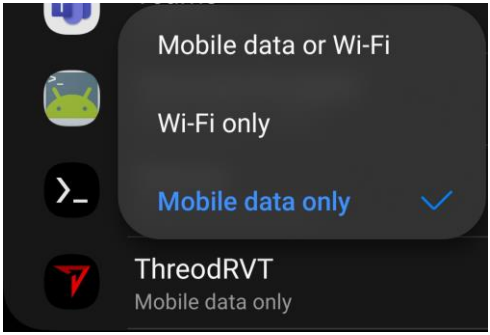
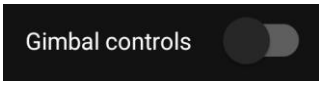


Figure 31: Mobile data for online maps

- If the smartphone is to be used offline, user must download/generate desired offline maps beforehand while connected to the internet. Read more in chapter 6.3.6.

6.3.4 Main UI

Darker red buttons are disabled – toggle "Gimbal Controls" to enable them.



- Gimbal controls container (closed) – shows/hides gimbal controls; closable/openable on drag icon click or drag. Read more in chapter 6.3.4.1.

- Audio Chat Push-to-talk (PTT) – Turns on microphone to communicate with GCS.

- Switch camera – Switches between daylight and IR camera.

- Settings – Changes to last settings tab used.

- POI list – Opens dialog containing list of all POIs.
  - Clicking on a POI in the list will zoom the map to the coordinates of the POI.

- NO MISSION MODE - Title of selected mission (none selected).
- Zoom joystick (left) – Zooms gimbal in and out.
- Main joystick (right) – Rotates gimbal.

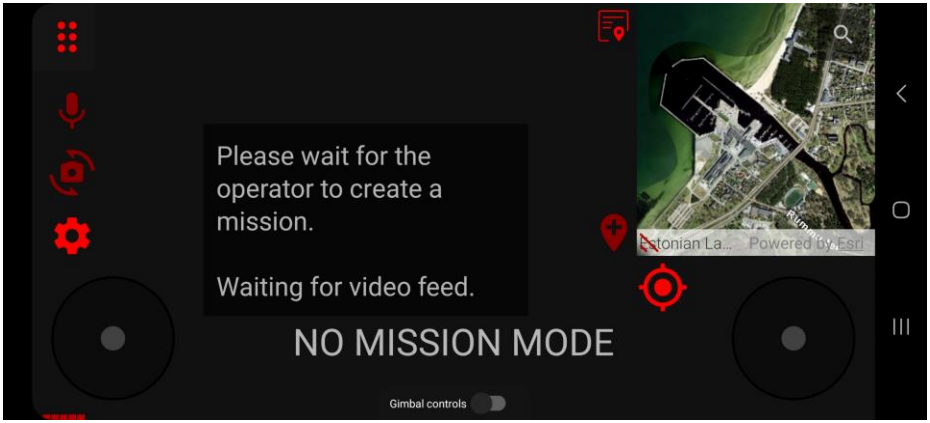


Figure 32: Main UI – no mission mode

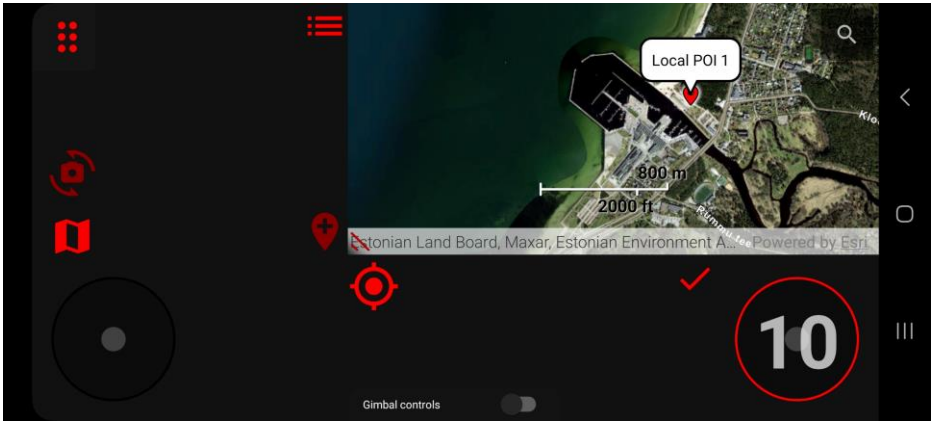
- The map window is resizable by dragging the red drag icon near the bottom left corner of the window.

- Cancel center map view timer - Resets map view to center right away. Available if “Center map view after 10s idle” enabled from map settings.

- Add POI (point of interest) – Marks gimbal target location on map. Disabled in no mission mode.

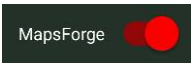
- Focus on device location – Centers map view to device’s location.

- Taping on the map places a new POI on the tapped location. When using ArcGIS, the new POI will be selected after creation (title displayed) and the main joystick can be used to nudge the location of selected POI in direction of joystick angle for 10 seconds.

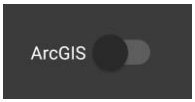


- If user nudges the POI location during the 10 seconds, timer will be reset. When the timer runs out or user clicks the submit button, POI title callout will be dismissed, and normal joystick behavior is restored.

- When using MapsForge clicking on a POI on the map, shows a dialog with the coordinates of the POI.



- When using ArcGIS clicking on a POI on the map will display POI title in a callout, clicking on the callout will open the dialog. Long click on the callout will delete the POI.



- By toggling "Public" the POI is shared to the server.

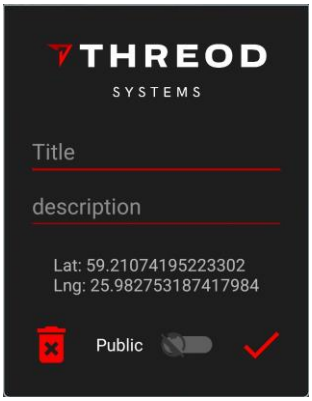
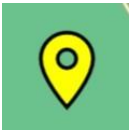


Figure 33: POI dialog in servered modes

Red – local POI →

Yellow – public POI →



6.3.4.2. Controlling the gimbal

Not available in datacenter mode.

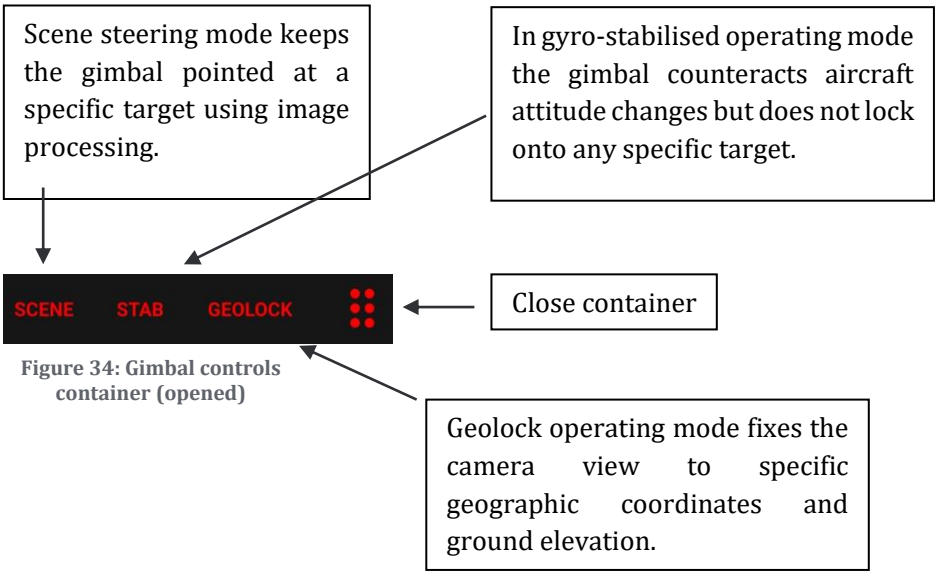


Figure 34: Gimbal controls container (opened)

Current gimbal mode can be seen in the top left of the over screen display (OSD).

Figure 35: Over screen display (OSD)

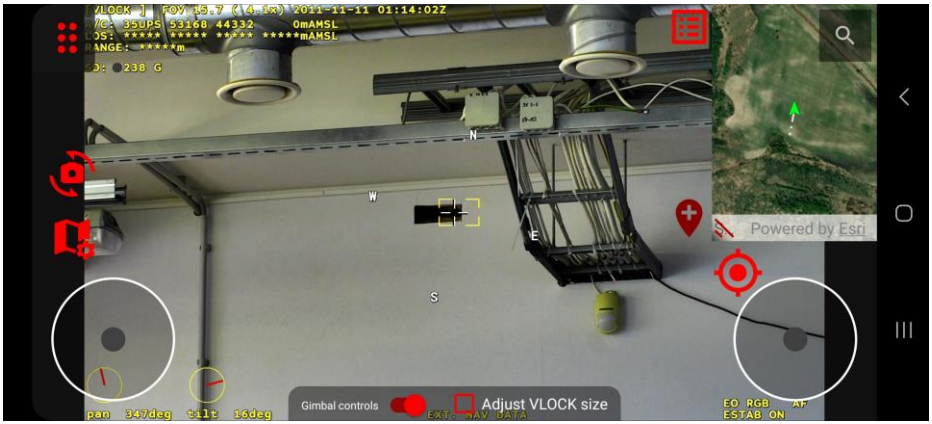


Figure 36: VLOCK activated

Video lock is used to visually track moving or stationary targets. Gimbal uses an image processing algorithm to match the tracking box on consecutive video frames and moves the camera when the tracking box is not centered on the frame.

To activate VLOCK, gimbal controls must be enabled. Tap on an object in video feed to place the tracking box.

In VLOCK mode the main joystick (right) nudges the tracking box to the direction of the joystick.

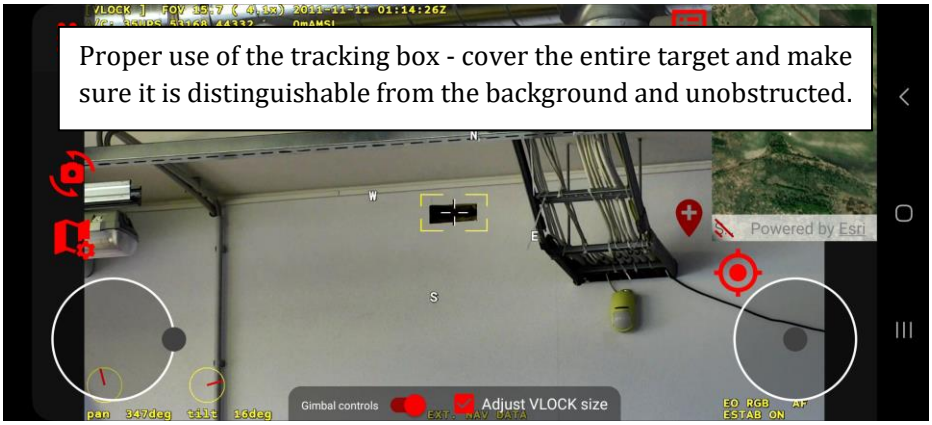


Figure 37: Adjusting VLOCK tracking box size

If VLOCK mode is activated – Adjust VLOCK size checkbox is displayed, if checked the zoom joystick (left) will adjust the tracking box size.

6.3.5 Camera settings

Disabled if “Gimbal Controls” are OFF:

- Defog - Turns defogging feature on/off (improves visibility in foggy and low light conditions)
- Black hot - Feature that shows hot objects as black, instead of white.
- ICR (Infrared cut filter) – Improves image quality and colors during the day by reducing certain infrared wavelengths.
- Color enhancement – Enables three enhancement options below:
    - Denoise – Reduces image distortion in low light conditions.
    - Enhance mode – Improves image contrast.
    - Sharpening – Sharpens contours of objects for enhanced detection.

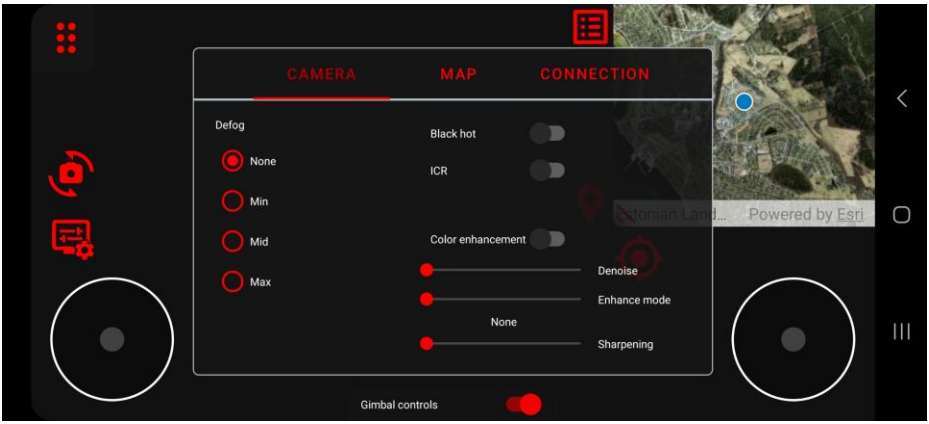


Figure 38: Settings – Camera

*** Gimbal controls not available in datacenter mode**

6.3.6 Map settings

User can switch between the map engines from map settings:

6.3.6.1. ArcGIS by ESRI

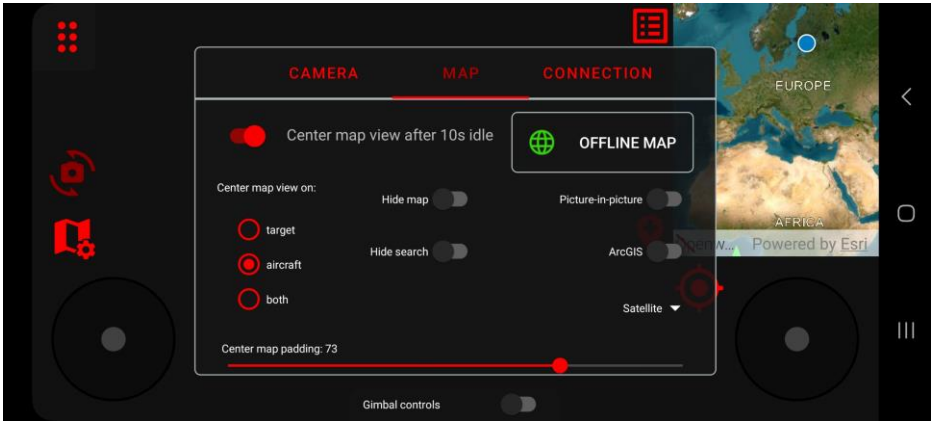


Figure 39: Settings – map [online map*]

Settings: Map tab

- Center map view on:
  - Target – Map centers on the gimbal target (TRG coordinates)
  - Aircraft – Map centers on the aircraft (UAV coordinates)
  - Both – Shows both the gimbal target and the aircraft in view.
- Basemap selection – Map to be used when using online map. Choose between satellite, topographic, terrain and street basemap.
- Offline Map – Enter offline map generation submenu (see figure 36 on next page).
  - Icon changes according to online*/offline map use.

* Map currently in use

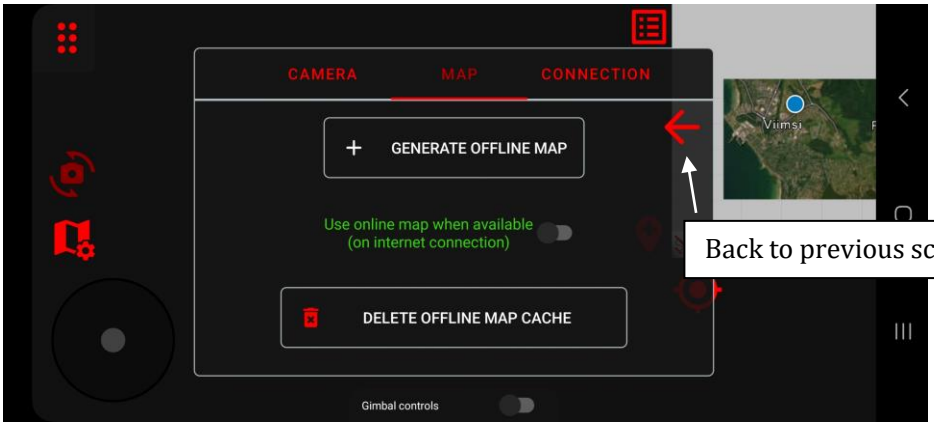


Figure 40: Settings – Offline map submenu [offline map*]

- Use online map when available – If disabled always use offline map.
  - Green color – Internet connected; can use online map.
  - Red color – No internet; offline capabilities only.

- Delete offline map cache – Prompts the user to delete all ArcGIS generated offline maps.
- Generate offline map – Displays previously generated offline areas overlay on the map.

Figure 41: Generate offline map

- For adding a new offline area click on the corresponding button which will overlay a preview area of the cache extent to be generated (see figure 41). Zoom to desired location and click “Start Job”.

- Note: ESRI supports for a maximum of 150,000 tiles to be exported in a single request from their world imagery service, thus look for the green border around the cache extent before starting the generating job.
- Red border indicates that the cache extent exceeds the supported tile count for exporting.

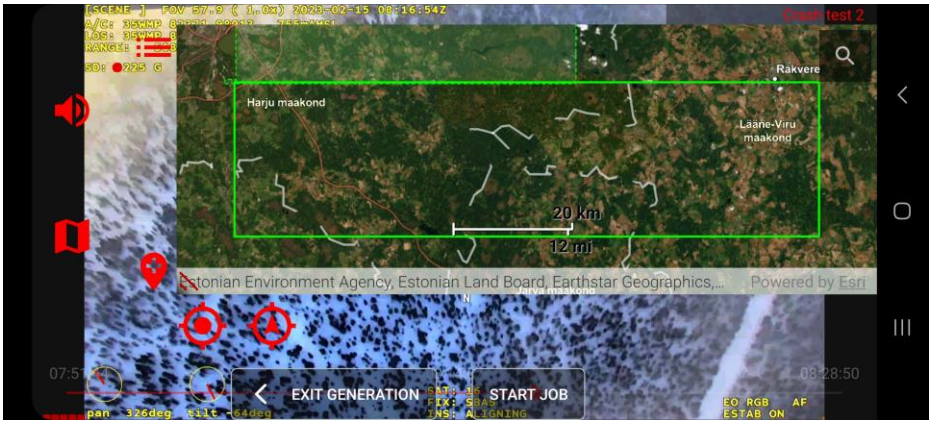


Figure 42: Add offline area

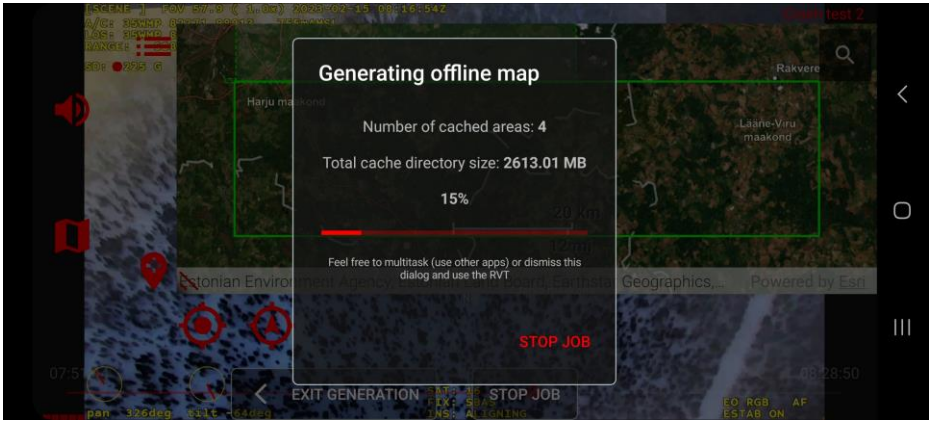


Figure 43: Generating job started

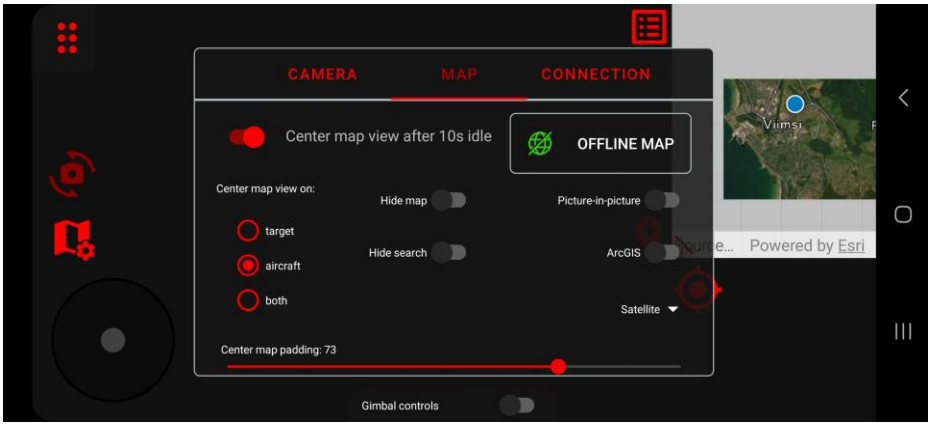


Figure 44: Settings - Map [offline map*]

- Center map padding – Amount of padding around the focus of the map (target/aircraft/both). Change this value to increase/decrease scale of map when centering on mission or device location.
- Hide map – Hides map.
- Hide search – Hides search (visible when using ArcGIS).
- Picture-in-picture – Shows map in the lower center part of the screen.
- Center map view after 10s idle (no touch) – Provides possibility to control the map without centering automatically. Disable to look around the map for more than 10 sec.
    - Enabled: Touching the map starts a 10 second timer which the user can end by taping the appeared button.
    - Disabled: Button displayed – center on target/aircraft/both once – on click only.

* Map currently in use

6.3.6.2. MapsForge

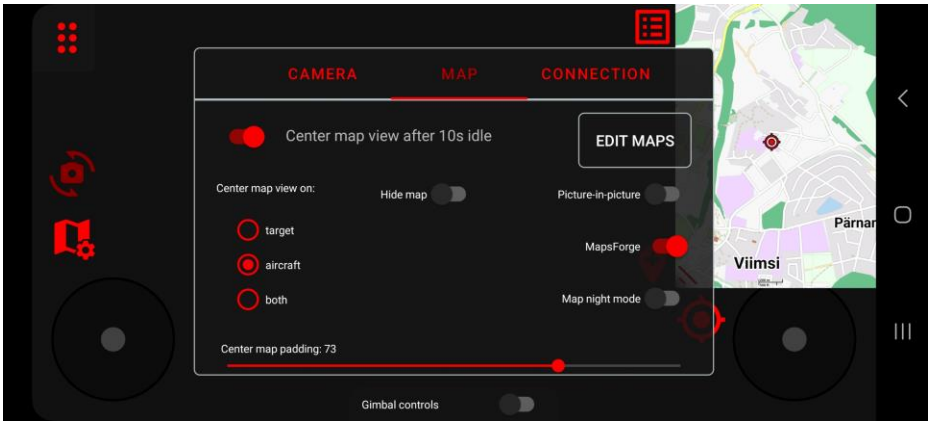


Figure 45: Settings - Map [MapsForge]

- Map night mode – Changes map to dark theme.
- Edit Maps – Opens a dialog from where user can download / update map files [REQUIRES INTERNET CONNECTION]

Downloading MapsForge map files

- Make sure the device has internet access.
- Click on “Edit Maps” button.
- From the dialog choose the region from which to download map file(s).

Figure 46: Map download – choose region

- Map files will now load.
- Select countries to download map files of.

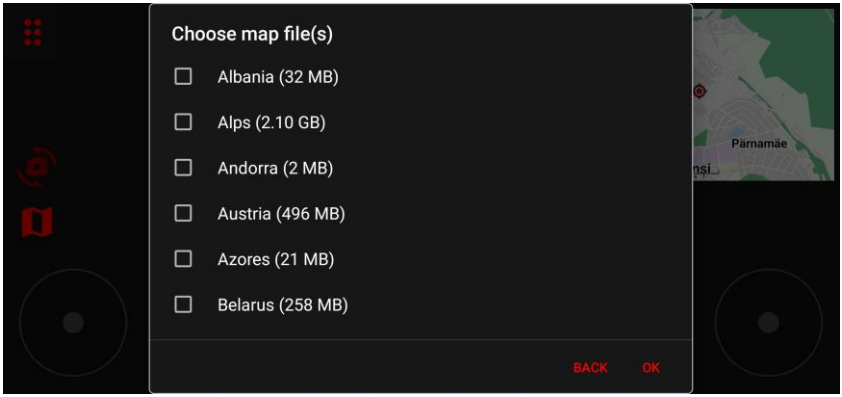


Figure 47: Map download – choose countries

- Once file(s) have been selected choose OK

- If some files were already downloaded previously the app will ask to either skip or overwrite these files.
    - Overwrite – updates the map to latest version available.
    - Skip – skips the file(s), does nothing and goes to next file.

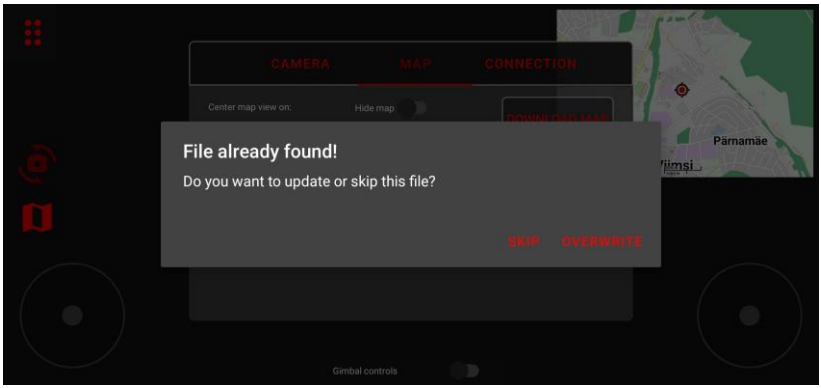


Figure 48: Map download – map file already downloaded

- File(s) will begin downloading. While progress dialog is shown please do not exit the application, this could cause the file to corrupt.
    - If application closes while downloading and map file corrupts then on next launch a toast will be shown to inform the user than a map file has been corrupted. File will be deleted automatically and will need to be redownloaded.

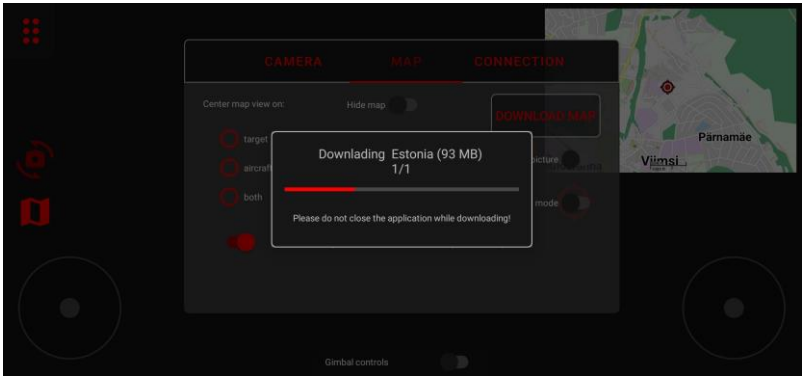


Figure 49: Map download – Downloading map file

6.3.7 Connection settings

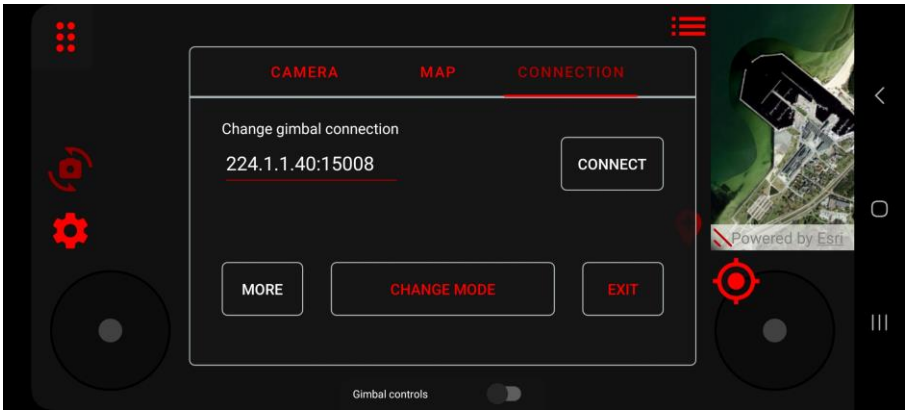


Figure 50: Settings – Connection [Serverless]

- Change gimbal connection - User entered gimbal IP address. This is changed only during special occasions. Standard IP address is fixed.
- Connect - Apply user entered gimbal address.
- Change Mode – Open mode menu.
- More – Displays more options dialog.

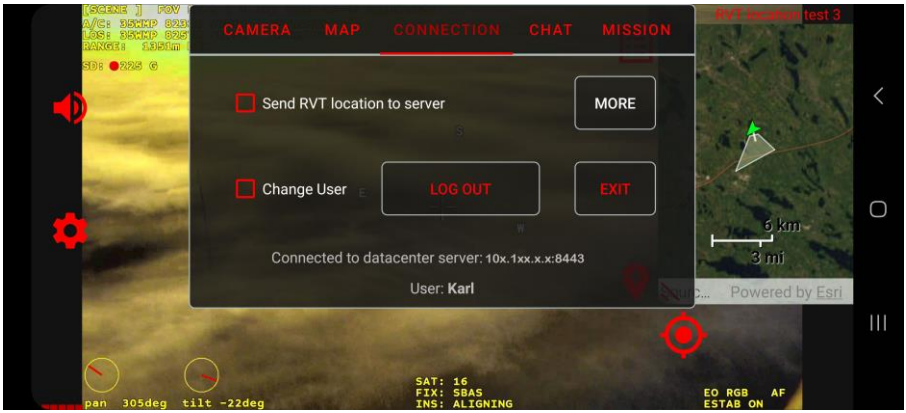


Figure 51: Settings – Connection [Datacenter]

- More – Displays more options.
- Send RVT location to server – If checked, location of the RVT will be sent to the connected server every 15 sec.
- Change user – If checked, will delete user credentials from device at logout.
- Log out – Logs user out and returns to the main screen.
- Exit – Exit application.
- Connected to server - Displays currently connected server IP address with port.
- User - Displays currently logged in username.

6.3.8 Direct mode

“Ongoing mission found” appears automatically when operator has created a live mission. The live video feed appears shortly after.

Other functionality same as in other modes.

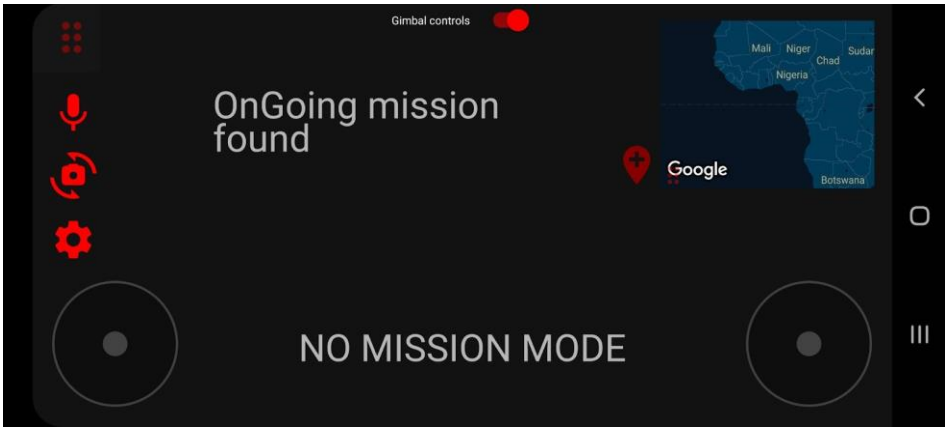


Figure 52: Direct mode main UI – Mission found

6.3.9 Datacenter mode

Datacenter mode UI is like that of Direct mode UI, except that pressing on “NO MISSION FOUND” provides a list of previous missions that can be played.

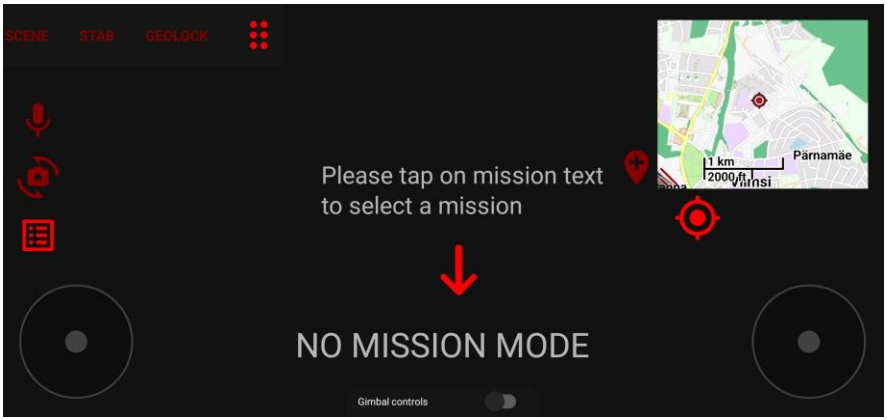


Figure 53: Datacenter mode – no mission mode

- “Ongoing mission found” appears if server found a live mission.

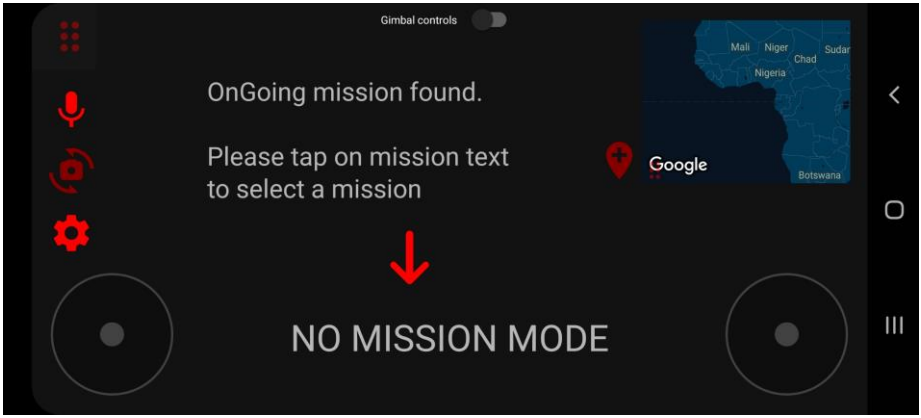


Figure 54: Datacenter mode – Ongoing mission found

- Clicking on “NO MISSION MODE” displays missions list.

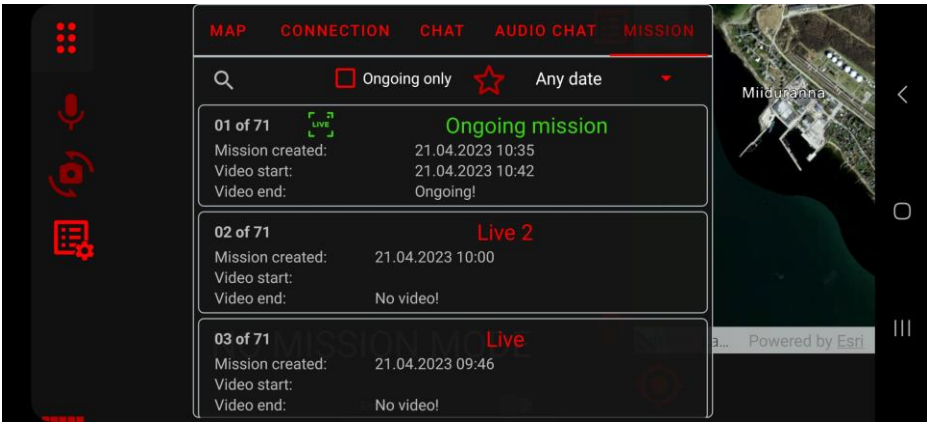


Figure 55: Datacenter mode – missions list

- Green titles indicate an ongoing mission.
- Red titles indicate a recorded mission.

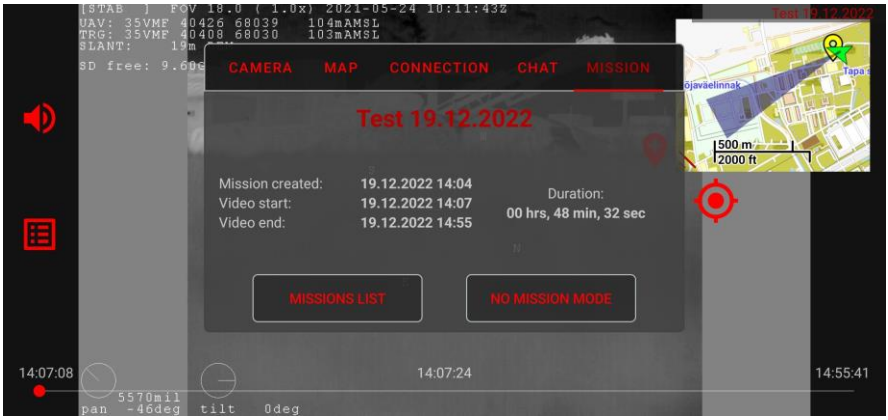


Figure 56: Datacenter mode – mission view

6.3.10 Playback controls

Begin in datacenter mode, select a mission (title in red) to playback from the missions list.

- Tap anywhere on video to pause/resume playback.
- Double tap on (left) side of the video - Go backwards in playback -5sec.
- Double tap on (right) side of the video - Skip forwards in playback +5sec
- Toggle speaker mute - Disables catching UDP voice packets.

- Play icon - Resume playback.
- Seek bar - Seek video playback by dragging left/right.

- Time (left) - Video start time in UTC time?
- Time (center) - Video playback time, click to skip to specific time.
- Time (right) - Video end time in UTC time?

Figure 57: Playback UI

6.3.11 Chat settings

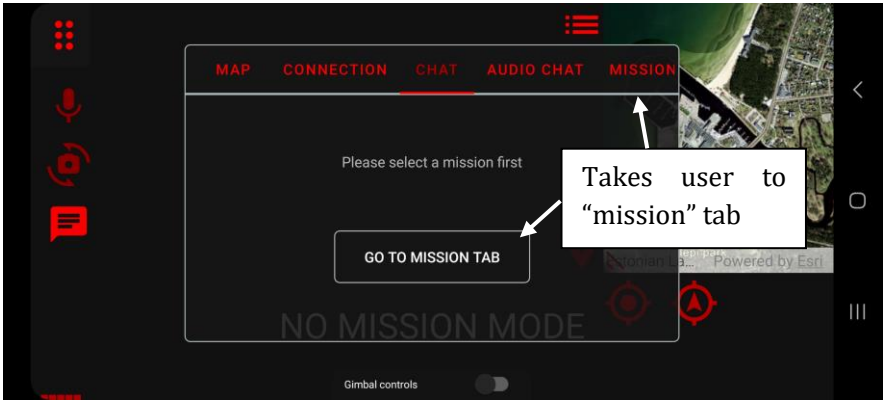


Figure 58: Settings – Chat – no mission mode

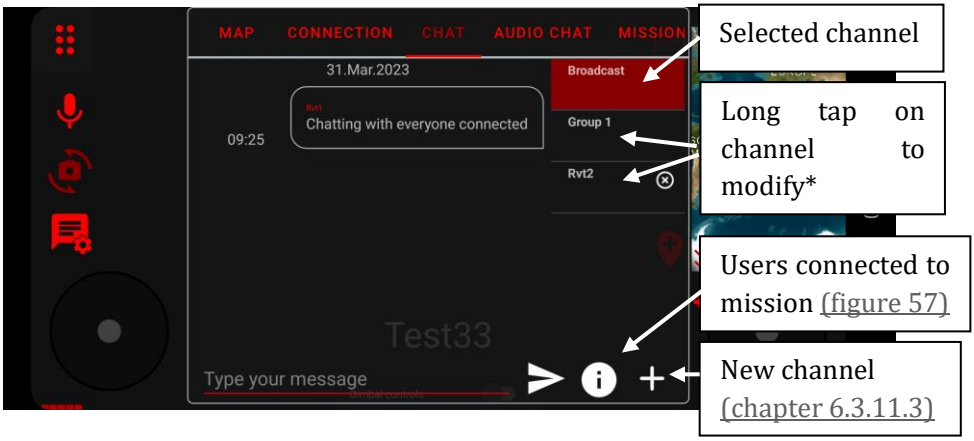


Figure 59: Settings – Chat – mission/playback mode

* Only the channel creator can modify the channel.

6.3.11.1. One-to-one channels

If a channel has only two users, username and online status will be displayed instead of channel name.

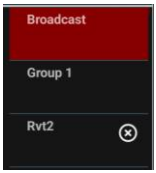
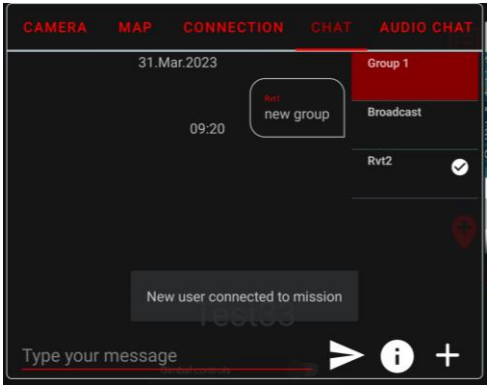


Figure 60: One-to-one channel example

6.3.11.2. Users connected to mission

If the checkbox is checked, the app displays a message when a new user connects to mission.

Figure 61: Connected users dialog



Online status changes from "offline" ⊗ to "online".

Figure 62: New user connected to mission

6.3.11.3. Creating a new channel

Plus icon opens the following dialog.

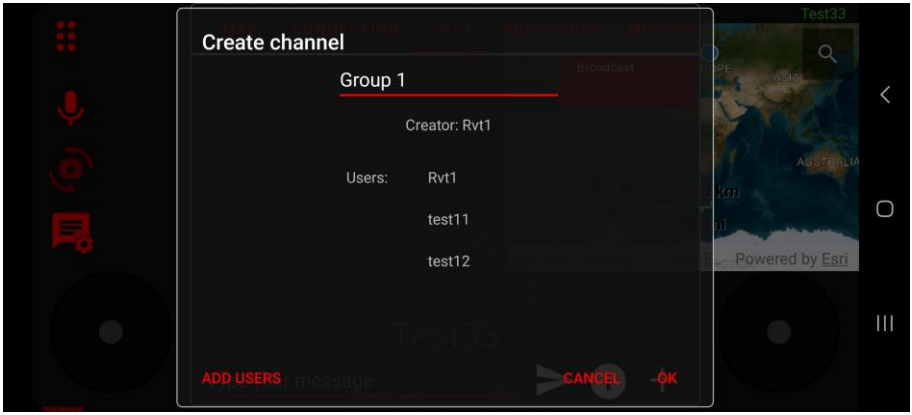


Figure 63: Creating a new channel

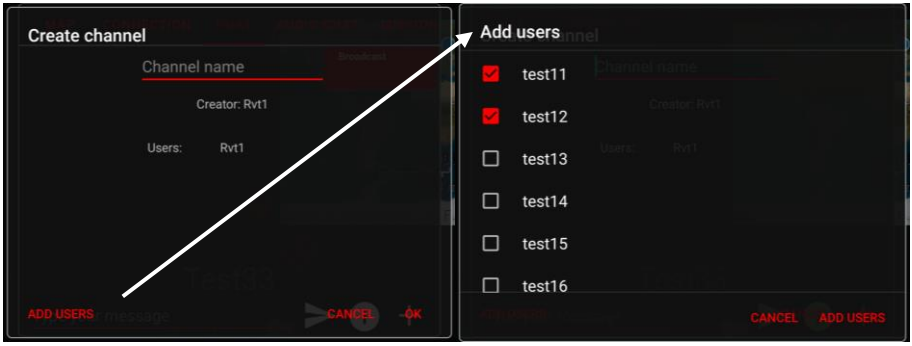


Figure 64: adding users to a channel

6.3.12 Audio chat settings

Audio chat is available in servered modes, while ongoing mission is selected.

- By default, audio chat is configured to be used in PTT – Push-to-Talk.
- When holding down the PTT button (transmission is active) the device vibrates*, and a green dot is displayed in the top right corner of the display.

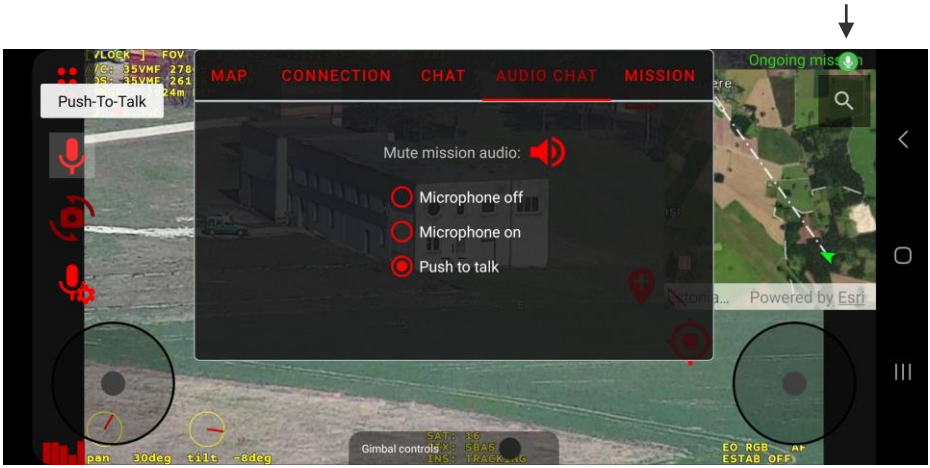


Figure 65: Audio chat settings (ongoing mission selected) [PTT]

VU-meter illustration is played when someone else watching the same mission is talking in audio chat in the bottom left corner of the display.

Voice over IP (VoIP):

- Mute mission audio – Toggle mission audio mute.

* Intensity of the vibration can be configured from android settings, “Sounds and vibration”, “System vibration”, “System vibration intensity”.

Changing audio chat configuration by choosing (1 of 3) radio buttons:

- Push to talk – Press and hold to transmit.
  Main UI PTT button **default**:

- Microphone on – Starts transmitting continuously.
  Main UI PTT button changes to:

- Microphone off – Stops transmitting.
  Main UI PTT button changes to:

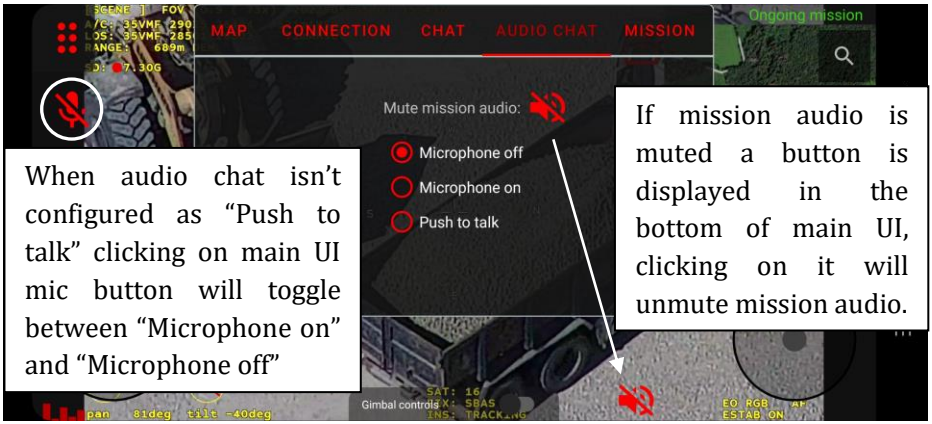


Figure 66: Audio chat settings (ongoing mission selected) [Microphone off]

6.3.13 Mission settings

- Pull down to refresh missions list with new missions from server.
- Click on mission to select it for playback or watch mission live.
    - Green titles indicate ongoing mission.
    - Red titles indicate a recorded mission.
- Search - Filters missions list with user entered search query (text).
- Ongoing only - Displays currently ongoing missions only.
- X of 163 - Mission index (x) of filtered missions lists.
- Any date - Displays missions after selected date.

Figure 67: Datacenter settings – mission – no mission mode

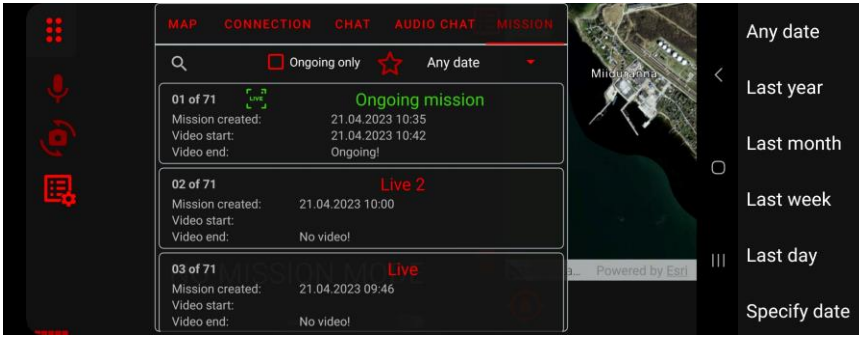
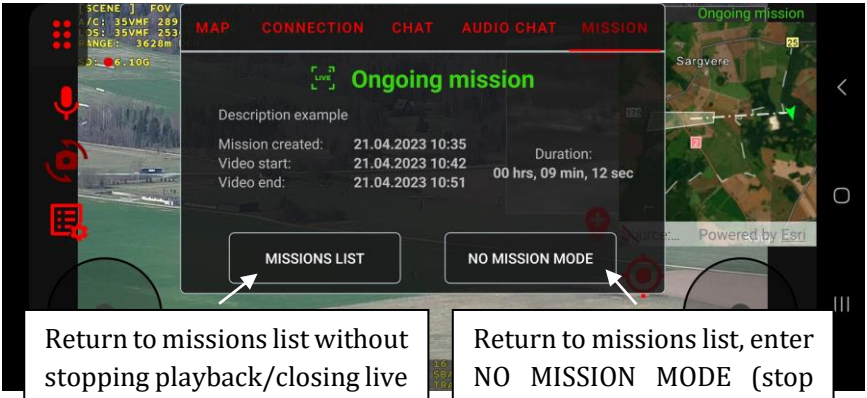


Figure 68: Datacenter settings – mission – ongoing mission selected



Return to missions list without stopping playback/closing live stream.

Return to missions list, enter NO MISSION MODE (stop playback/close live stream)

7 MAINTENANCE

	Each use	Monthly	Yearly
Charge battery	x	x	x
Check contacts	x		
Dry the equipment	x		
Clean contacts with contact cleaner		x	x
Update radio and GDT firmware			x
Update android application		x	x

7.1 CHARGE THE BATTERY

The BT-70716 battery can be charged using the provided battery charger or with USB charger adapter.

The batteries are Lithium-Ion batteries with a protective circuitry that prevents them from excessive discharge. When the battery's output voltage per cell drops to a certain threshold value, the battery will switch off and will need servicing by Threod Systems. For this reason, the batteries must be periodically charged even if not used. The battery level can be seen while using the USB charge adapter. Do not leave the battery at minimum level for more than two weeks without re-charging them.

7.2 DRY EQUIPMENT

After each use in a rainy, snowy, or humid environment. The case, along with the equipment should be dried before storage.

7.3 CHECK AND CLEAN CONTACTS

Before and after each use of the equipment, the user should ensure that all the contacts, especially radio modules pogo-pin connectors, are clean and that there is no moisture or particles inside them. In case there is any contamination in the connectors, the user should clean the connectors thoroughly with the supplied contact cleaner.

The user should clean all the contacts and equipment generally before storing it for longer periods and periodically during normal operations (once a month).

7.4 UPDATE RADIO FIRMWARE

The GDT software on the radio firmware will need updating periodically. This is not performed by the user, but by Threod Systems technician.

7.5 UPDATE ANDROID APPLICATION

The android application "ThreodRVT" requires semi-automatic updating. Once Threod Systems has released a software update, a notification will be received on the Samsung smartphone.

Internet connectivity required.

Clicking on the notification, changelog will be displayed, and the user can download the update package ThreodRVT_vXX.apk and install it.

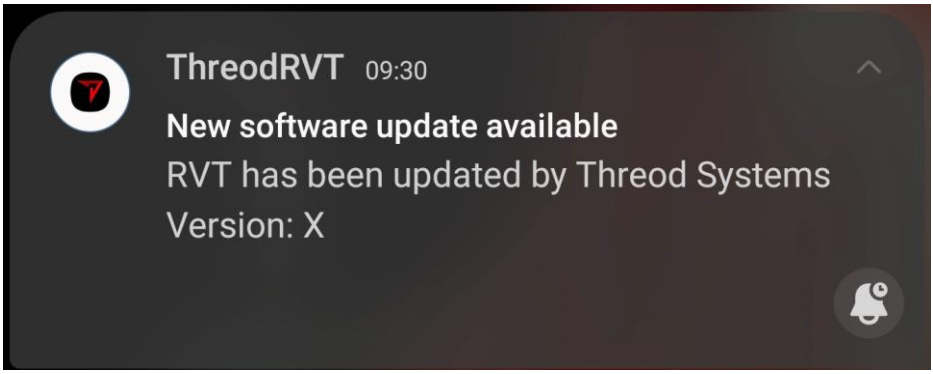


Figure 69: Application update notification

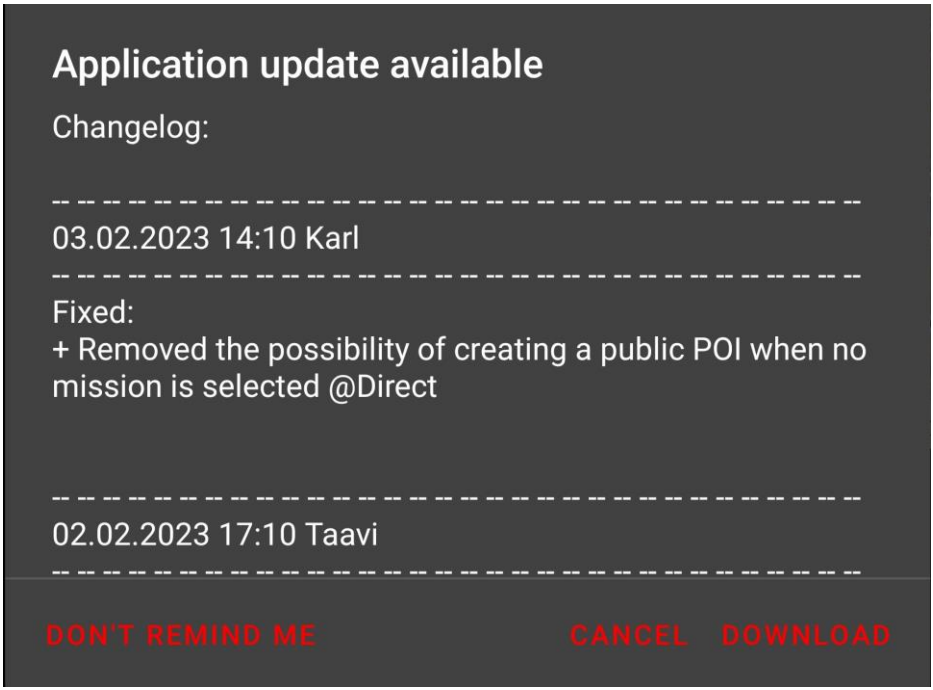


Figure 70: Application update changelog

Manually viewing the changelog or downloading the latest application package can be found from "**Connection**" settings, "**More**" and click on "**Manual Software Update**".

If the following error occurs whilst installing an application update:

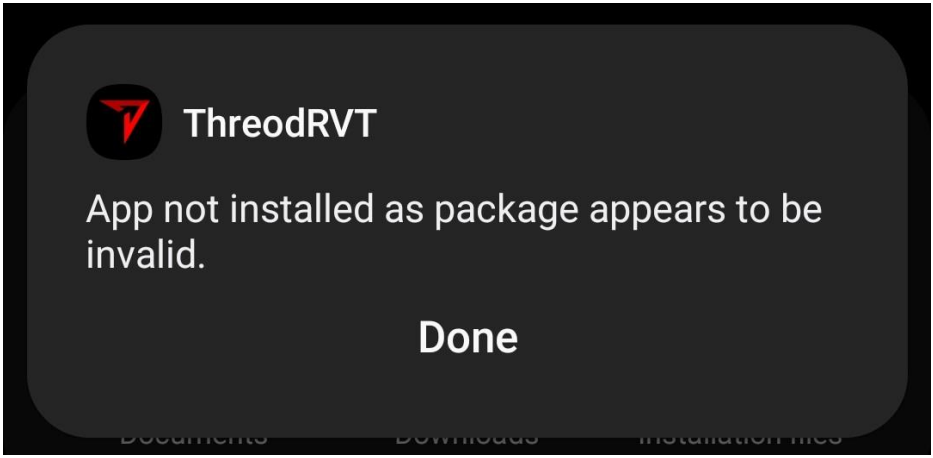


Figure 71: Application update failed

Please uninstall ThreodRVT first.

- This deletes all files associated with the application: settings, maps etc.

Then open the update package ThreodRVT_vXX.apk again for a clean installation.

NOTES