



FALCON 4G Report
The Spanish
Armed Forces
Regimiento de Defensa
NBQ "Valencia" n° 1

SEC TECHNOLOGIES

Authored by: **Martin Vařovský**



CHEM



1. INTRODUCTION

The Falcon 4G is a powerful long range reconnaissance detector that can detect, identify and measure chemical warfare agents and toxic industrial chemicals using two independent eye-safe pulsed tunable CO₂ lasers. Its patented laser technology is undetectable by laser warning devices, making it an effective tool for military and industrial applications.

2. TRIAL CONDITIONS

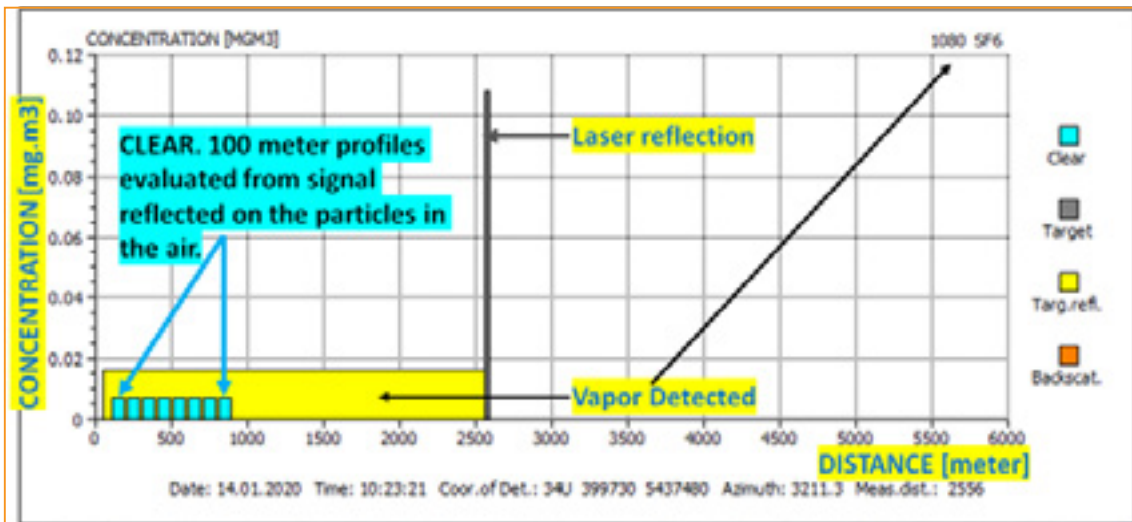
Date	January 14, 2020
Place	Military Base "Jaime I", Bétera (Valencia), Spain
Weather	sunny
Wind speed	6 – 7 m/s
Humidity	73 % (morning), 35 % (midday)
Pressure	1021 – 102 mbar
Simulants¹	Sulphur Hexafluoride (SF ₆) – 1 kg in 4 releases, Ammonia (NH ₃) – 2x 0.75 l 25 % concentrate
Scenario #1	NH ₃ and SF ₆ , released in the tent, max. distance 2556 meters
Scenario #2	SF ₆ released in the open area
Scenario #3	SF ₆ released in the open area, min. distance ≈100 meters

¹ Please refer to the last page of the report for detailed information about the simulants.

3. METHODOLOGY

Falcon 4G B was tested in a partially forested area with limited spaces for cloud observation and detection against the sky background.

The vehicle version of the detector was mounted on a tripod with a car pan-and-tilt platform/gimbal and operated from a PC. Measurements were conducted in three scenarios, using both manual and scanning modes. The simulants used in these trials were SF₆ and Ammonia (25% liquid concentrate), which were released separately and jointly. A total of 1.5 liters of liquid Ammonia concentrate (two releases of approximately 0.75 liters each) and 1 kg of SF₆ (four releases of approximately 160 grams, 160 grams, 160 grams, and 500 grams) were used.



4. SCENARIO 1: AMMONIA (NH_3), AND SULPHUR HEXAFLUORIDE (SF_6)

Release point was positioned at a distance of 2556 meters on a small hill. Gas release was performed from a small tent with an open front side.



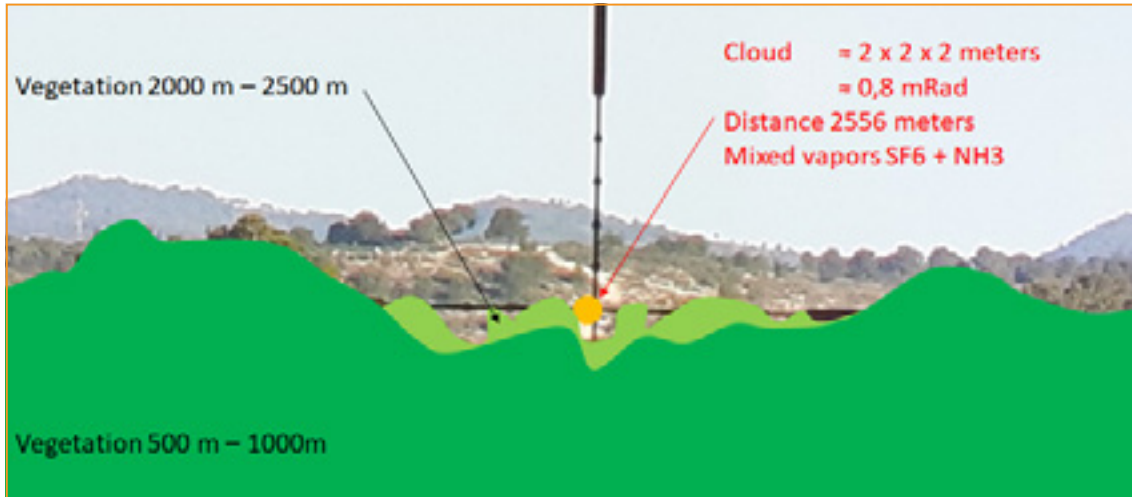
Fig. 1 • Tent about 2 meters of height with a base of 2x2 meters.



The trial involved separate releases of SF₆ and Ammonia, as well as a combined release to create a mixed cloud.



The measuring path was chosen to test the limits of CBRN reconnaissance in realistic scenarios. The detector was positioned in a narrow passage, no wider than approximately 2 mRad, with dense vegetation and trees on either side. This unique scenario seemed impossible at first sight.



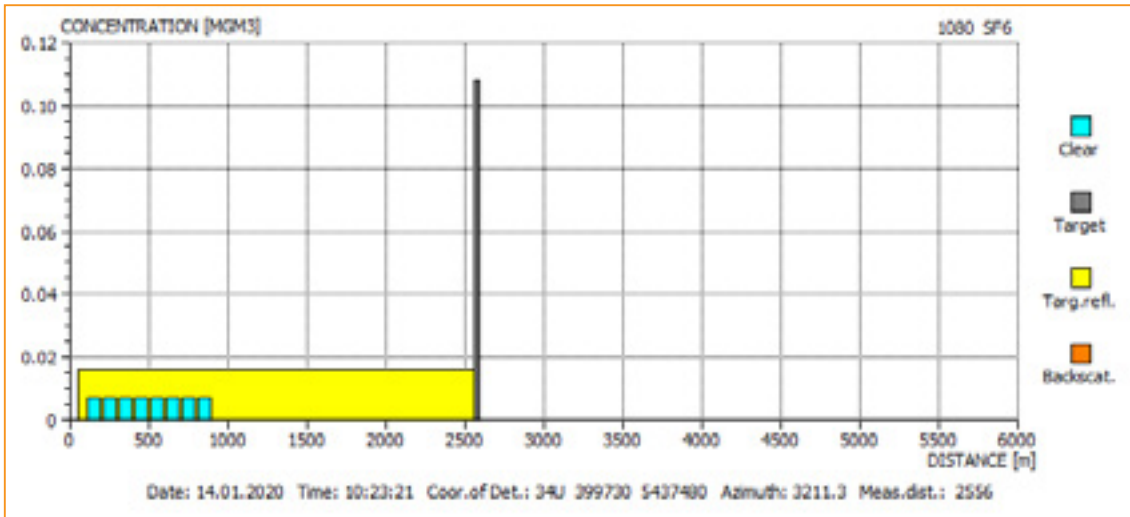
5. SCENARIO #1

The first scenario began with chemical reconnaissance along a preset path. A number of scans were conducted randomly between 10:04 and 10:09, which showed a clear path with no dangerous gases.

5.1 SULPHUR HEXAFLUORIDE (SF₆), 1ST RELEASE

Between 10:21 and 10:23 more control scans were conducted, showing clear air once again. Signal was then given to open the bottle with a simulant. The SF₆ release from the bottle lasted for 30 seconds, during which Falcon 4G continuously scanned the preset path. Approximately 7 seconds after opening the bottle, at 10:23:21, SF₆ was detected and identified by Falcon 4G. The concentration measured by Falcon 4G was 0.01608 mg/m³.

Continuous scanning showed that the concentration of SF₆ was falling (at 10:31:39, approximately 9 minutes after the release, the measured concentration had fallen to 0.005379 mg/m³). At 10:32:00, Falcon 4G did not detect any dangerous gases, and the air was clear. SF₆ had already been blown away and flowed down the hill (SF₆ is 5 times heavier than air and very similar to Sarin).



5.2 AMMONIA (NH₃), 2ND RELEASE

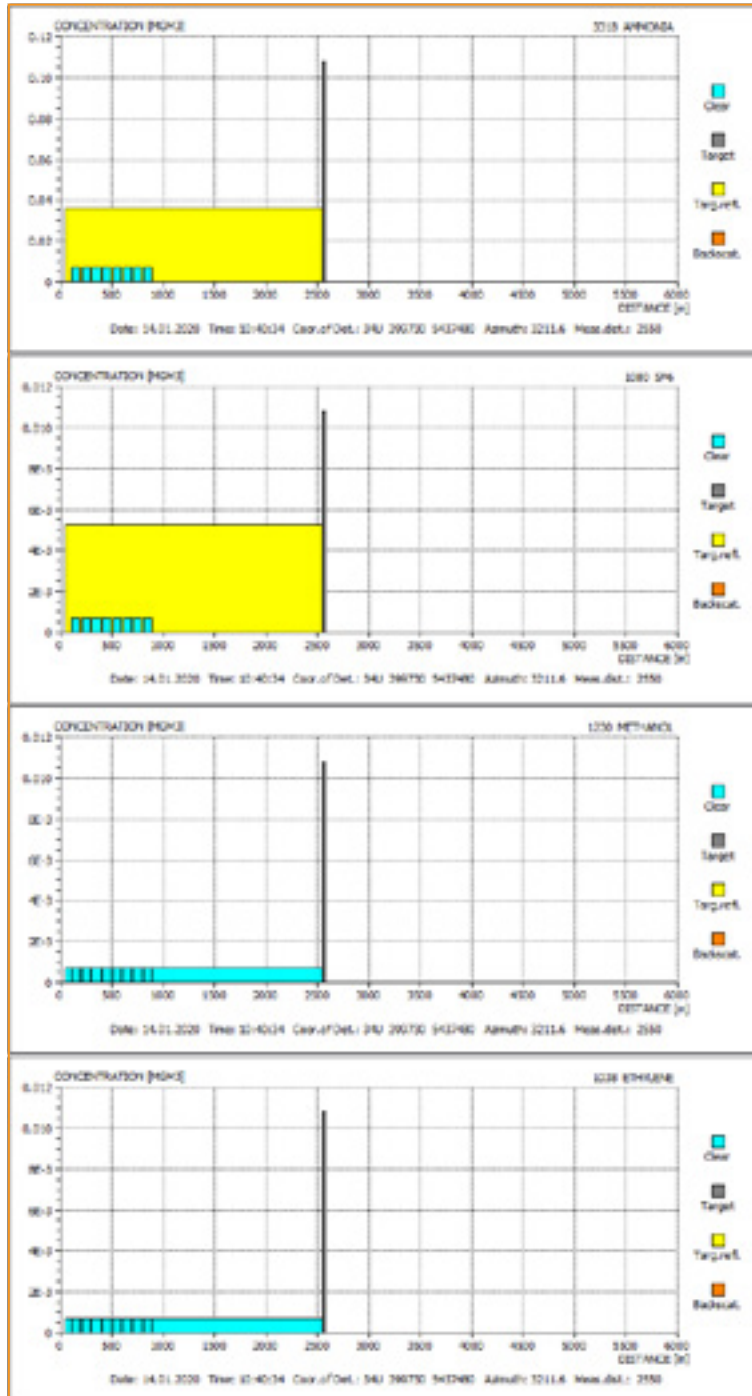
At 10:37:00, 0.75 liters of liquid Ammonia (25% concentration) were dispersed in the tent on soft paper. At the beginning of the Ammonia dispersion, Falcon 4G showed clean air. However, the Ammonia was picked up and detected 1 minute and 47 seconds later, at 10:38:47, with a concentration of 0.04321 mg/m³. Subsequent scanning revealed the concentration of Ammonia peaking at 0.05256 mg/m³.

5.3 SULPHUR HEXAFLUORIDE (SF₆) & AMMONIA (NH₃) MIXED IN THE CLOUD, 3RD RELEASE

Third release of the primary scenario was conducted in automatic scanning mode. The measuring paths and scanning modes were chosen and set up by the soldiers from the NBC Defense Regiment. While Ammonia was still present in the tent and

evaporating from the dispersed liquid, we conducted a second release of SF₆ within the tent. Falcon 4G was continuously scanning the preset path, detecting and identifying Ammonia. It took 12 seconds for the concentration of SF₆ to reach the necessary threshold and be detected and identified.

The lowest concentration of SF₆ detected was 0.005291 mg/m³, while the highest was 0.01031 mg/m³. Ammonia remained at a stable concentration of 0.03203 mg/m³ with a variance of 0.0015 mg/m³ throughout the scanning period.





6. SCENARIO #2 - SULPHUR HEXAFLUORIDE (SF₆) RELEASE IN THE OPEN AREA

The second scenario was conducted between 11:05:00 and 11:08:00. The tent was removed, and the same location was used as in Scenario #1. The release of SF₆ was conducted in open air with a light breeze. The release nozzle was positioned approximately 2.5 meters above the ground. The bottle was opened at 11:05:30, and the first detection was noted at 11:05:39, nine seconds later. The concentration measured was 0.01879 mg/m³. The highest concentration detected and identified was 0.02396 mg/m³.

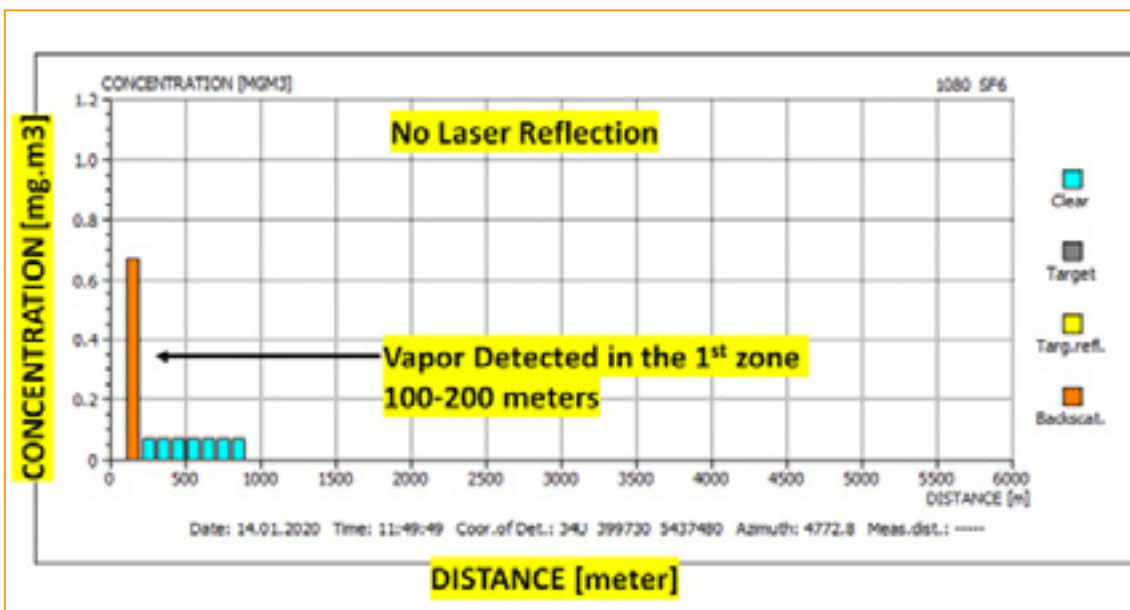
7. SCENARIO #3

In the third scenario SF₆ was released on the top of the vehicle in an open area approximately 100 meters from the detector. Measurement was done with an open path and no background ("shooting lasers" to the sky).



Fig. 2 • Scenario #3 Sulphur Hexafluoride (SF₆) release in the open area, min. distance≈100 meters

We have started 3rd scenario with the release of SF₆ from the top of the car (as seen on the picture above). As SF₆ is a 5 times heavier than the air it is expected to stay close to the ground. After start of the release it took 1:25 minute to detect SF₆ in the air. Simulant was detected at 11:49:49 in the zone 1 (100-200 meters). Average concentration in the 100 m zone was 0.6658 mg/m³. Nearly one minute later we have started detecting simulant in the second zone as well (200–300 meters). First detection in the zone 2 was at 11:50:58 with concentration level 0.6267 mg/m³.



8. CONCLUSION

The NBC Defense Regiment (Regimiento de Defensa NBQ "Valencia" n° 1) in Valencia made thorough preparations for the test, with the aim of not only conducting regular standoff chemical detection, but also assessing the advantages of active detection technology, such as the ability to detect small amounts of vapors from far away and identify gasses, and to use even narrow passages for long-range chemical reconnaissance.

The scenarios were intentionally challenging in order to push the technology to its limits and reveal its true capabilities. The demo was professionally prepared with great support and assistance during the trials from the NBC Defense Regiment, who not only provided professional observers on both the release and detection sites, but also assisted the SEC Technologies team with all necessary steps.

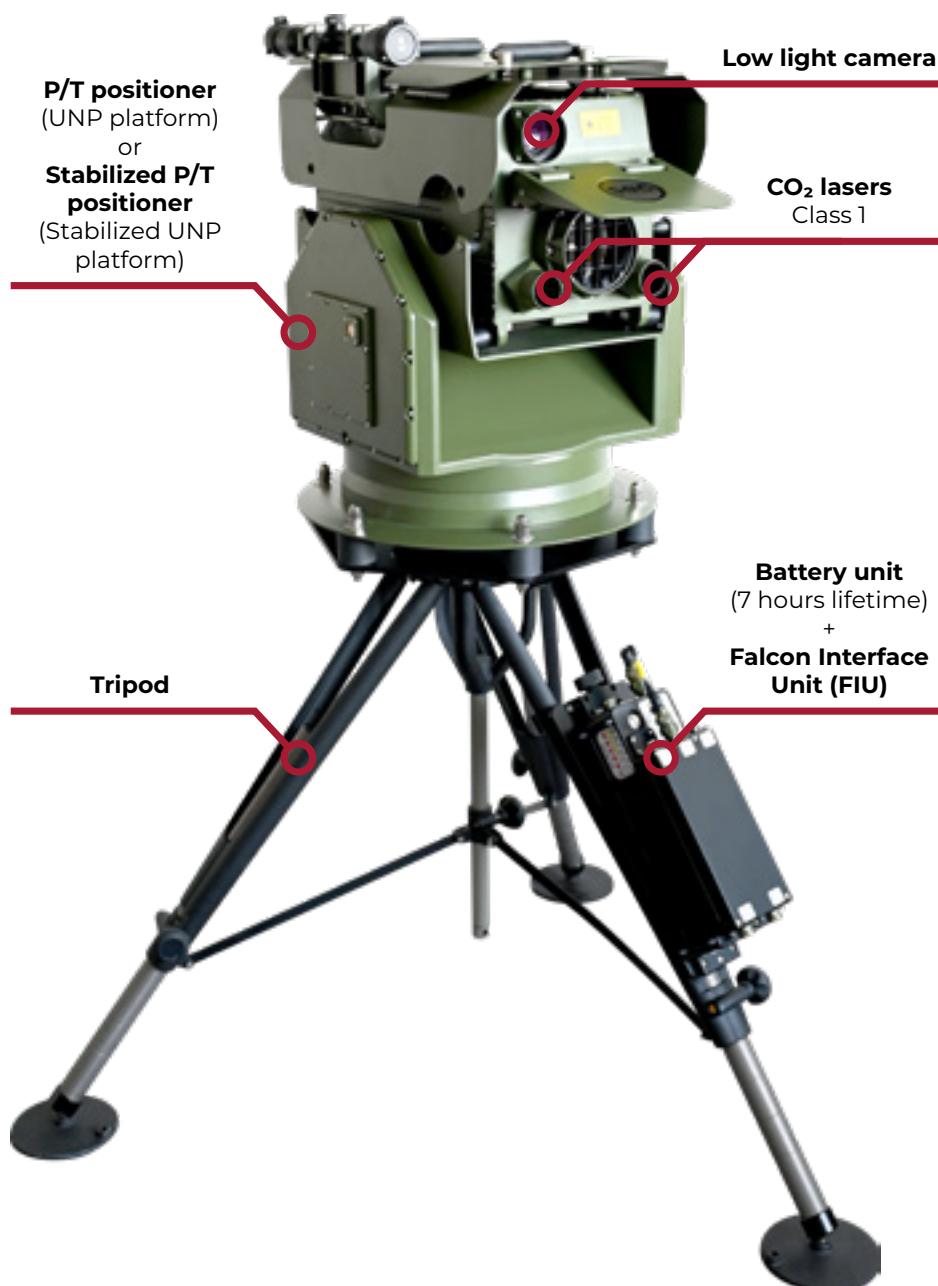
"Falcon 4G has reliably and quickly detected vapors in tiny quantities, even from a distance of over 2.5 km and in very narrow spaces between trees and vegetation. Its performance in this seemingly impossible scenario was truly unique and unmatched."

FALCON 4G

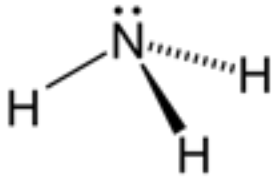
Long-Range Reconnaissance Chemical Detector

4th generation active stand-off detector based on eye-safe and undetectable laser technology

- ✓ **Detection**
- ✓ **Identification**
- ✓ **Quantification**
- ✓ **Up to 6 km**
- ✓ **Best sensitivity on the market**
- ✓ Distance to the cloud without triangulation
- ✓ Refractors not required
- ✓ No need to scan background

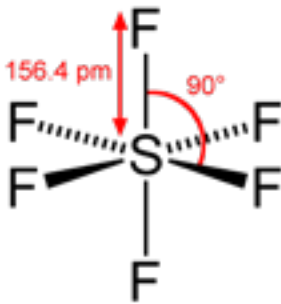


NOTES

**AMMONIA**

(NH₃, Molecular weight: 17.031 g/mol)

Ammonia is a colourless inorganic compound of nitrogen and hydrogen, usually in gaseous form with a characteristic pungent odour. Ammonia is irritating to the skin, eyes, nose, throat, and lungs. It is essential for many biological processes and has various industrial applications. Relative Air Density is 0.597 (lighter than air).

**SULPHUR HEXAFLUORIDE**

(SF₆, Molecular weight: 146.06 g/mol)

Sulphur Hexafluoride is a colourless odourless gas. Relative Air Density is 5.10 (5 times heavier than air and very similar to CWA agents).

Source: www.worldofmolecules.com.



SEC Technologies, s.r.o.

1. mája 4269
031 01 Liptovský Mikuláš
Slovakia

+421 905 327 966

martin.valovsky@sec-technologies.com
michal.simko@sec-technologies.com

www.sec-technologies.com

