Standoff, Wide Area Detection of SF_6 by Means of a Passive IR Imaging Spectrometer

E. Robert Schildkraut and Raymond F. Connors

Presented by E.R. Schildkraut

SF_6 and the Environment: Emission Reduction Strategies

Wyndham Emerald Plaza Hotel

San Diego, California

November 2, 2000

Introduction to Block

Founded 45 years ago (1956); working in military R&D

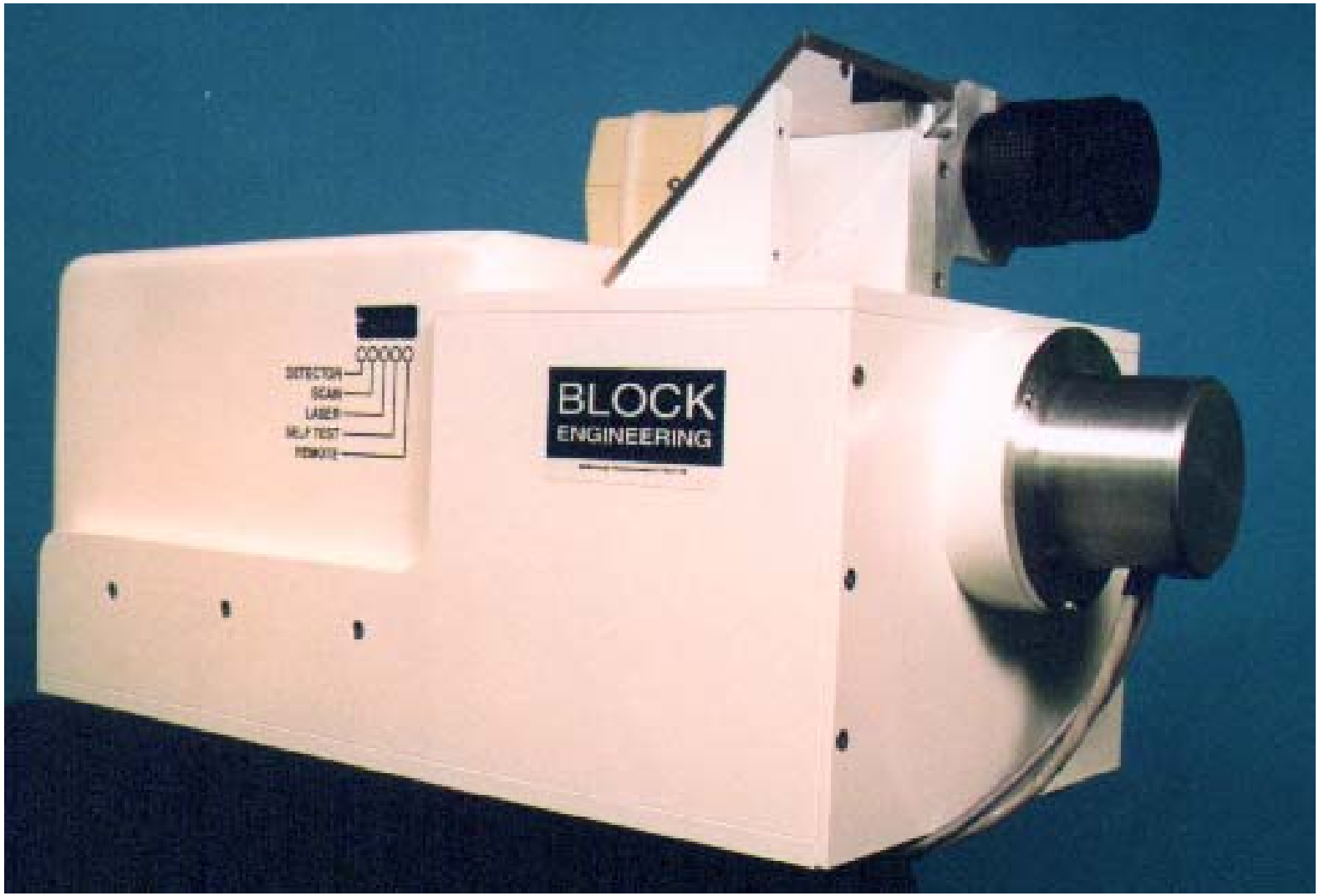
Created two spin-off commercial operations in analytical spectroscopy and ophthalmic equipment

High technology electro-optical company specializing in remote, standoff detection; primarily in the infrared spectral region

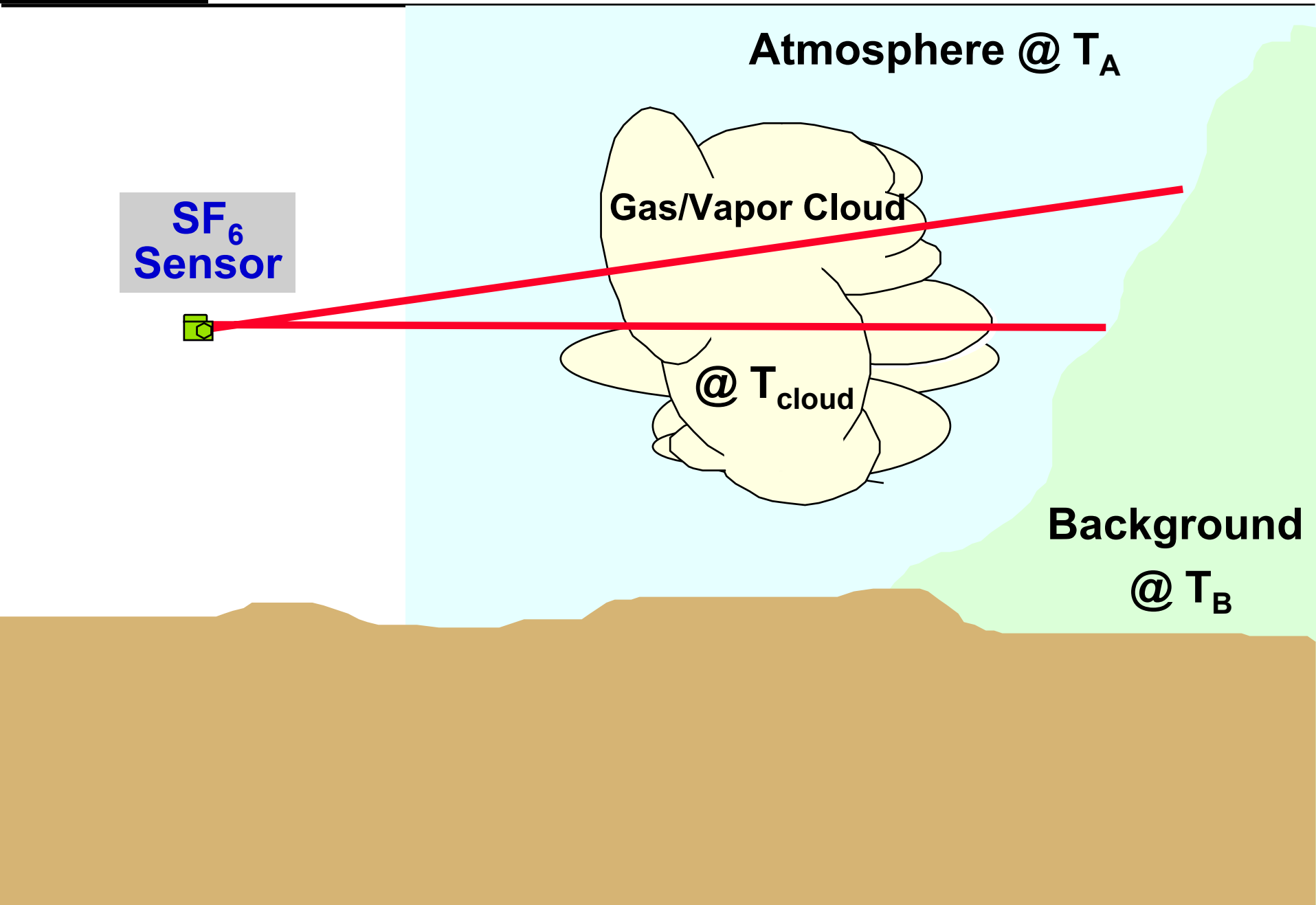
Selected technology for protection against nerve gas attack

Newest thrust: lower cost, industrial instrumentation, built for inventory and rapid delivery

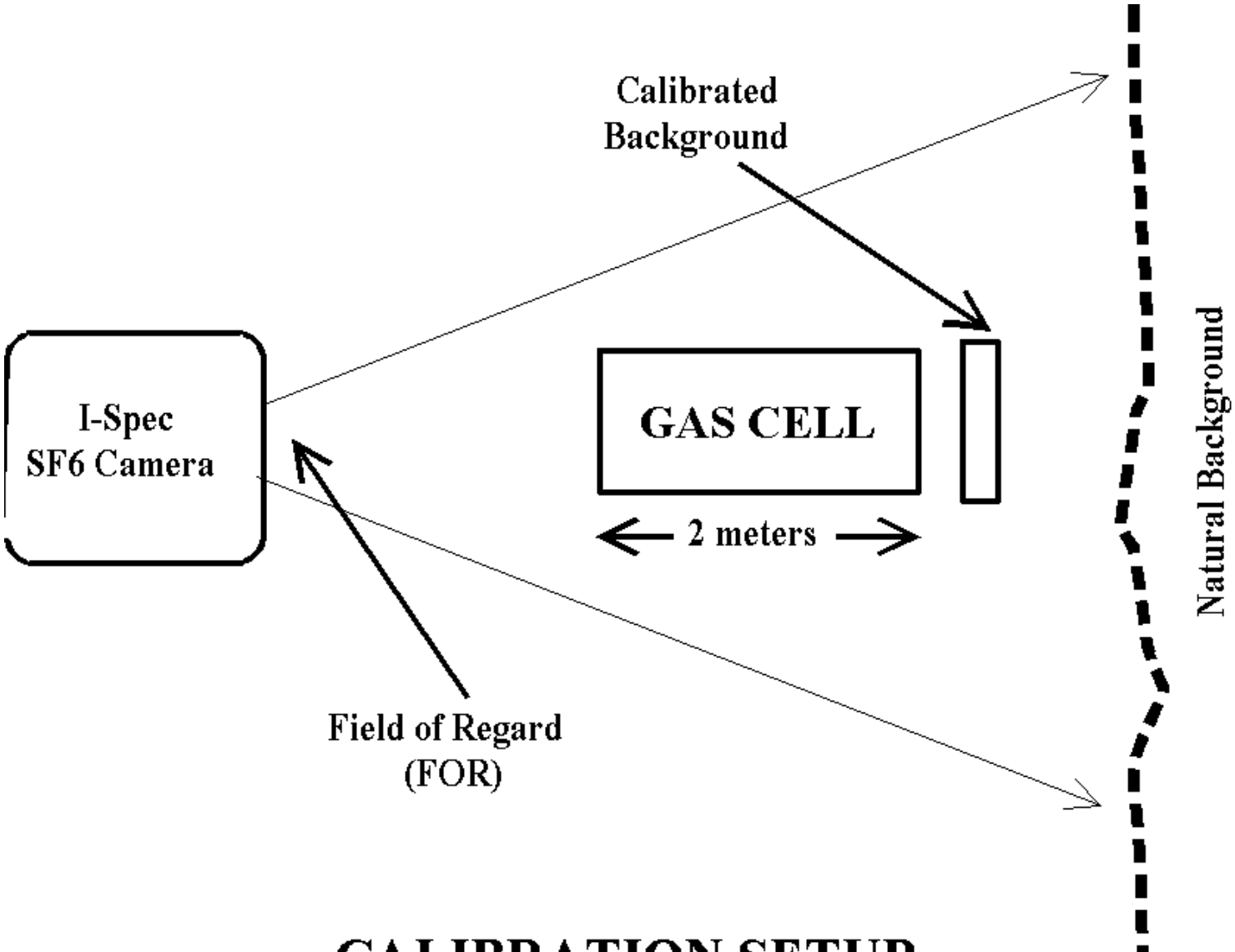
I-Spec SF_6 Camera



I-Spec/SF_6 Detection Scenario



Sensitivity Determination

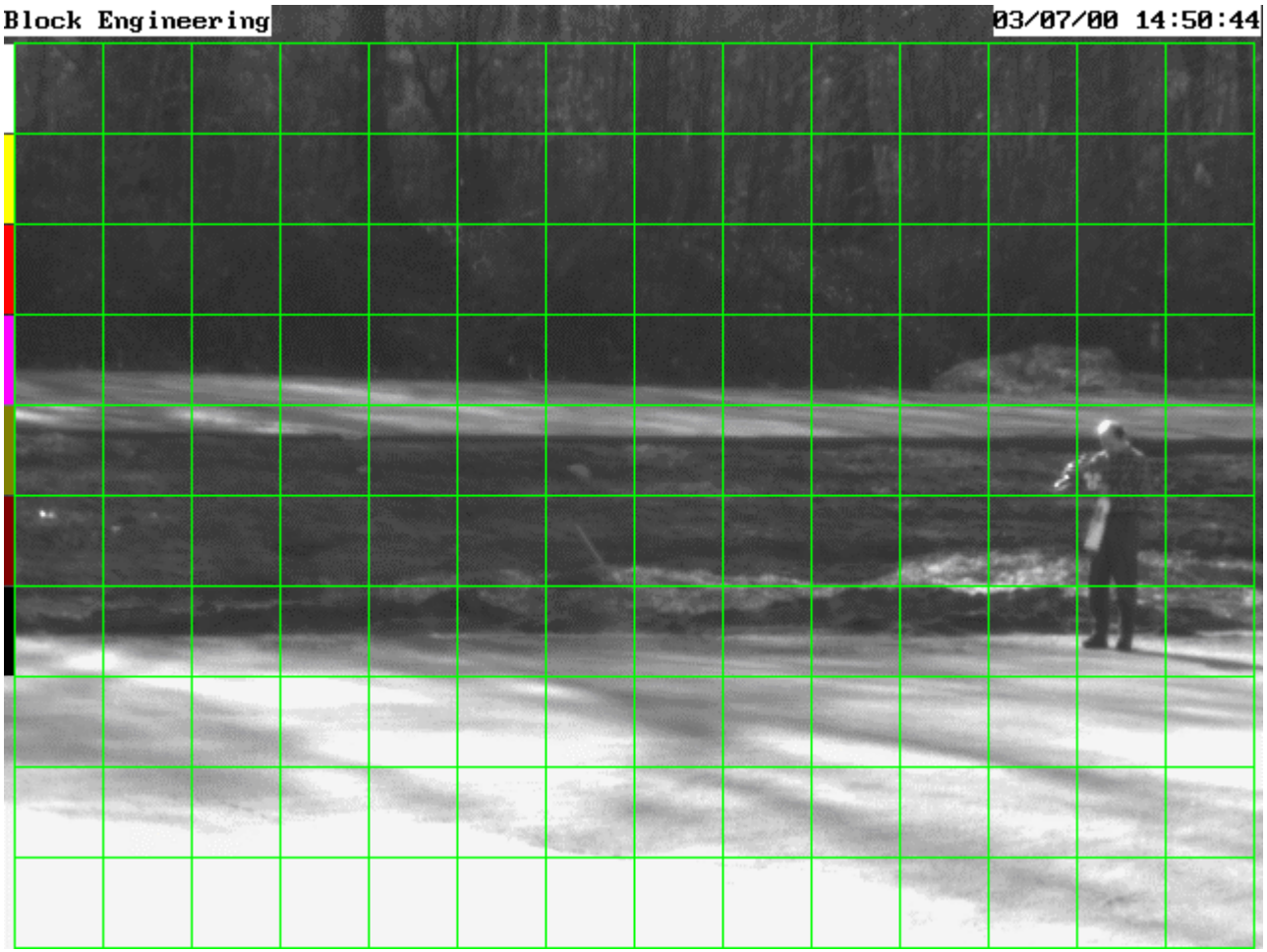


CALIBRATION SETUP

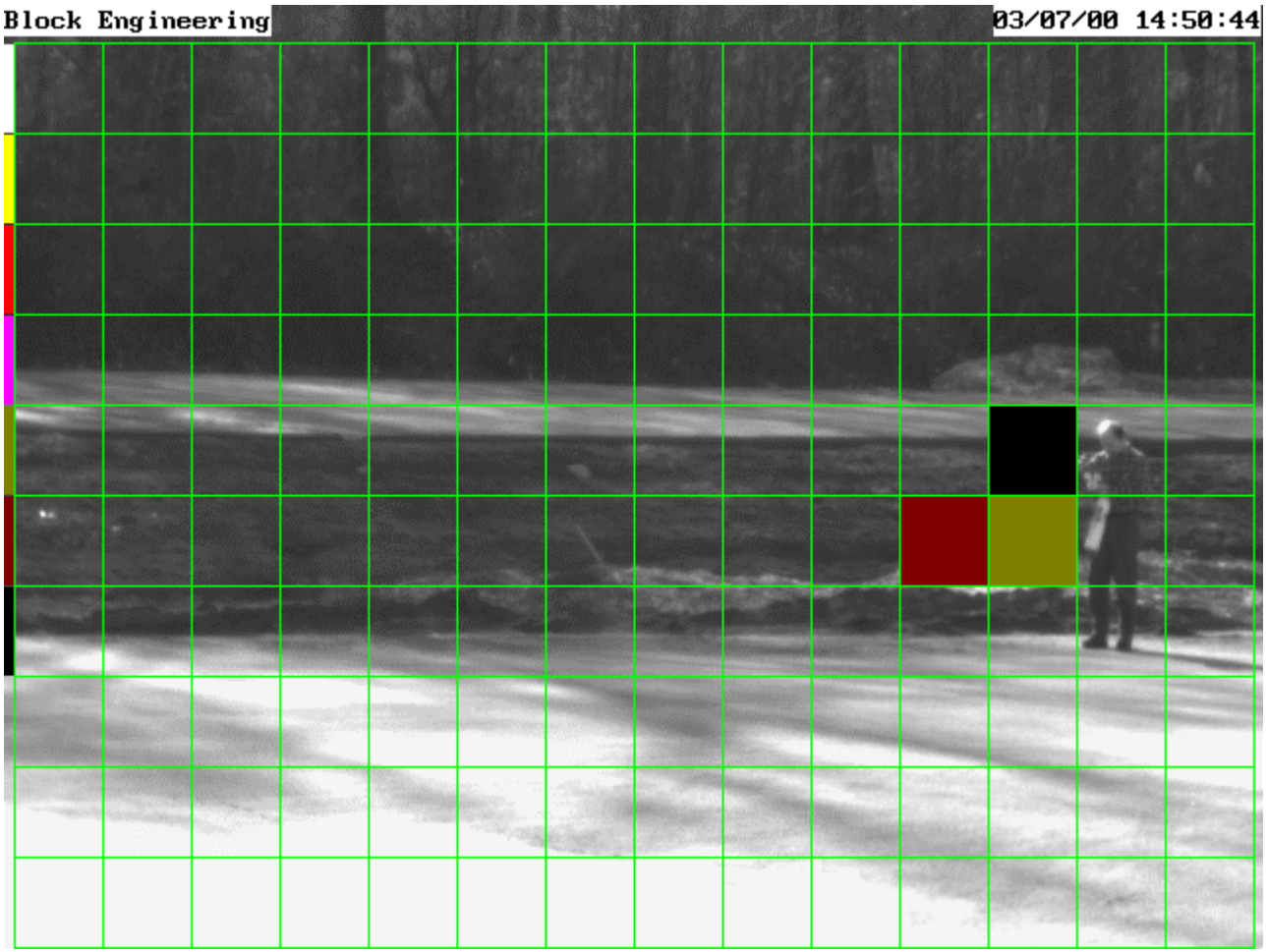
SF_6 Camera Key Specifications

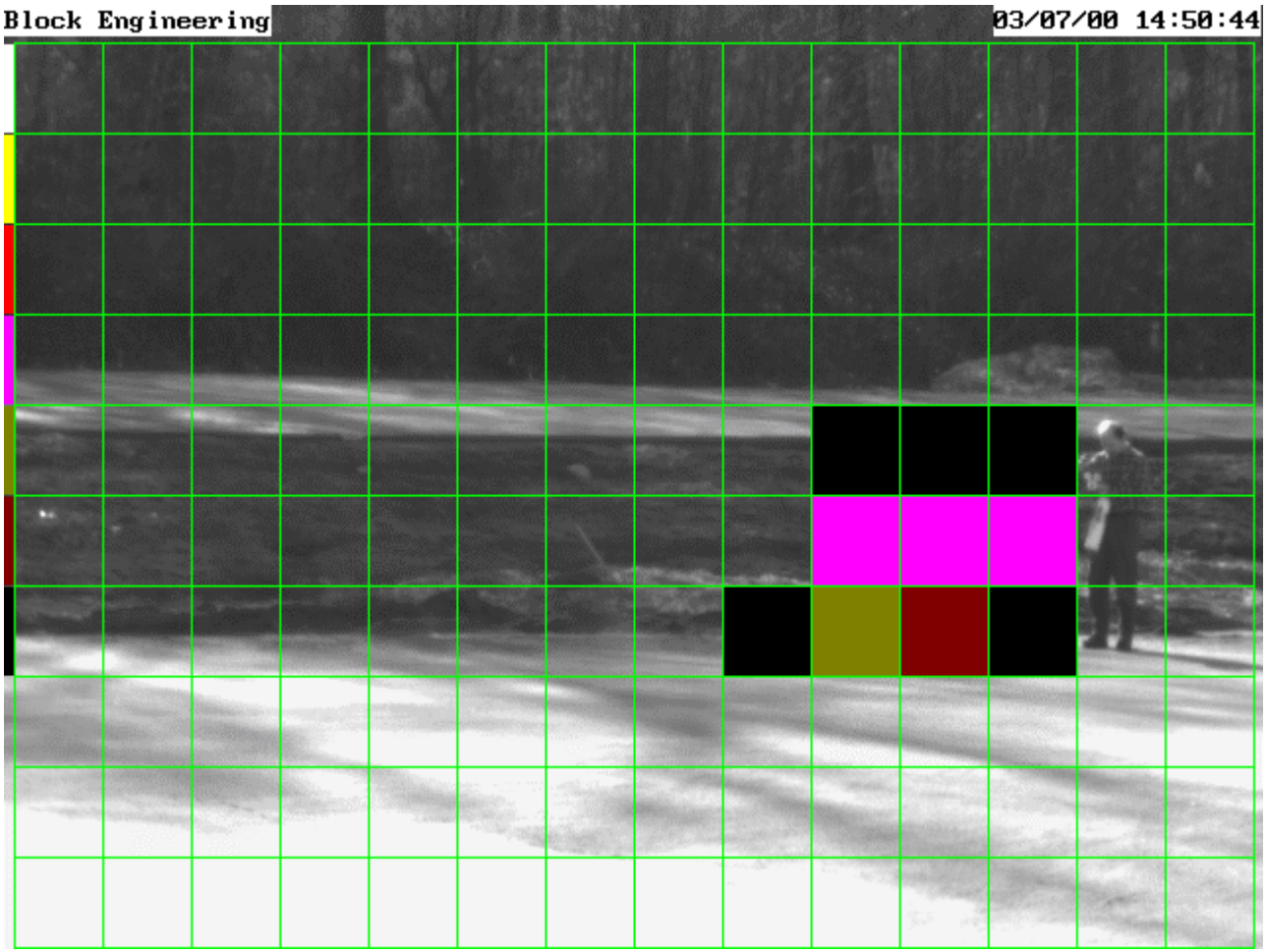
Field of Regard (FOR)	10 x 14 degrees (175 x 244 mRadians)
Instantaneous Field of View, IFOV (pixel)	1.5 degrees (26 mRadians)
Spectral Resolution, Wavenumbers	16 cm^{-1}
Spectral Scans per Second	140 (one full frame)
Sensitivity	3 ppm-meter @ ΔT=8.1C
Full Frames per Second	1
Data Reduction Time to Display	1 second
Data Storage and Archive	Std. PC, portable
Software	Win 95 or later
Typical File Size	300 kB per frame (approx)
Overall Size (optical head)	9 x 7 x 16 inches
Weight (optical head)	<15 pounds
Power (system)	100-240V DC-60Hz, <300W

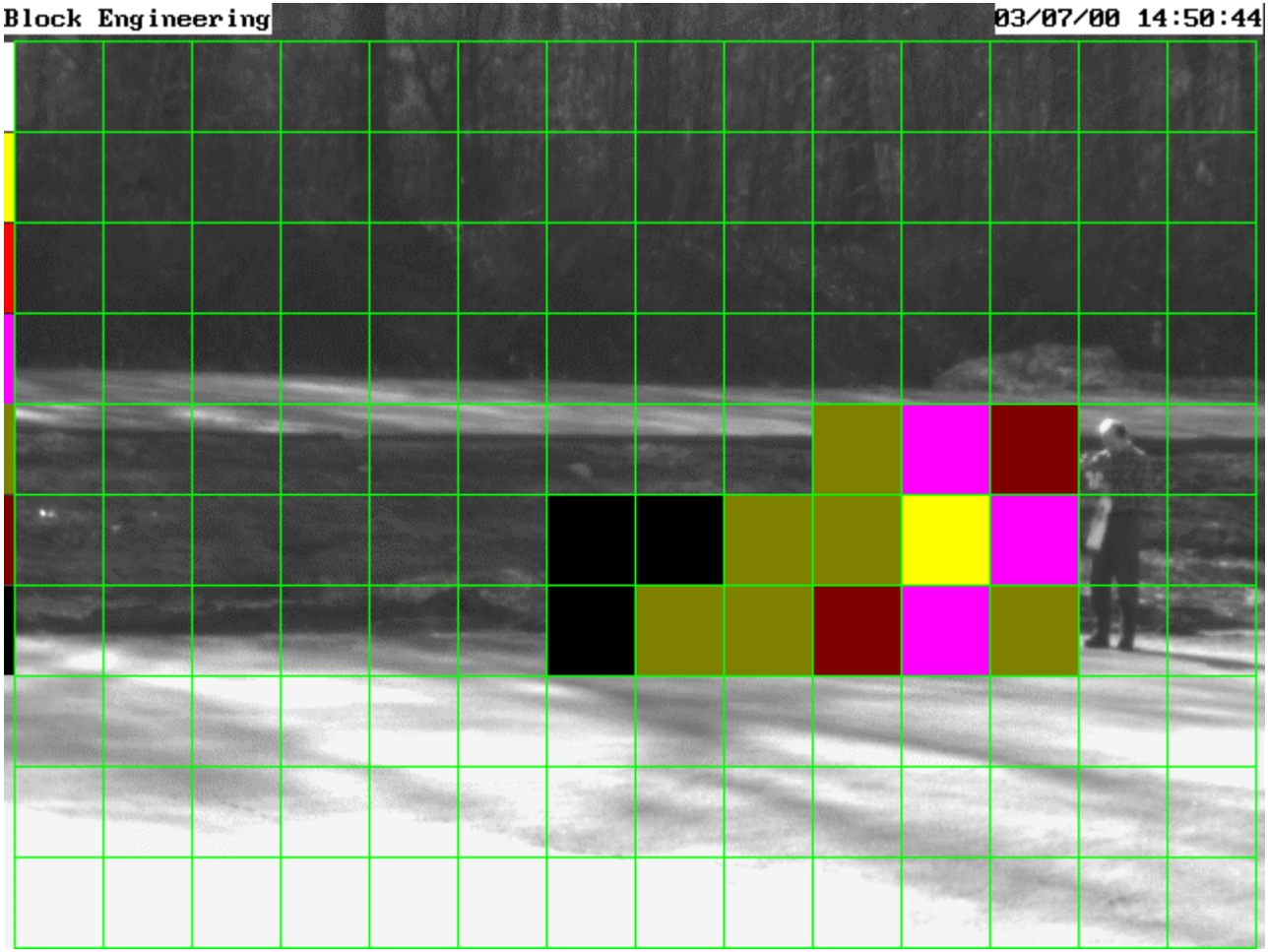
SF_6 Flow Begins at Approximately 20#/yr Rate

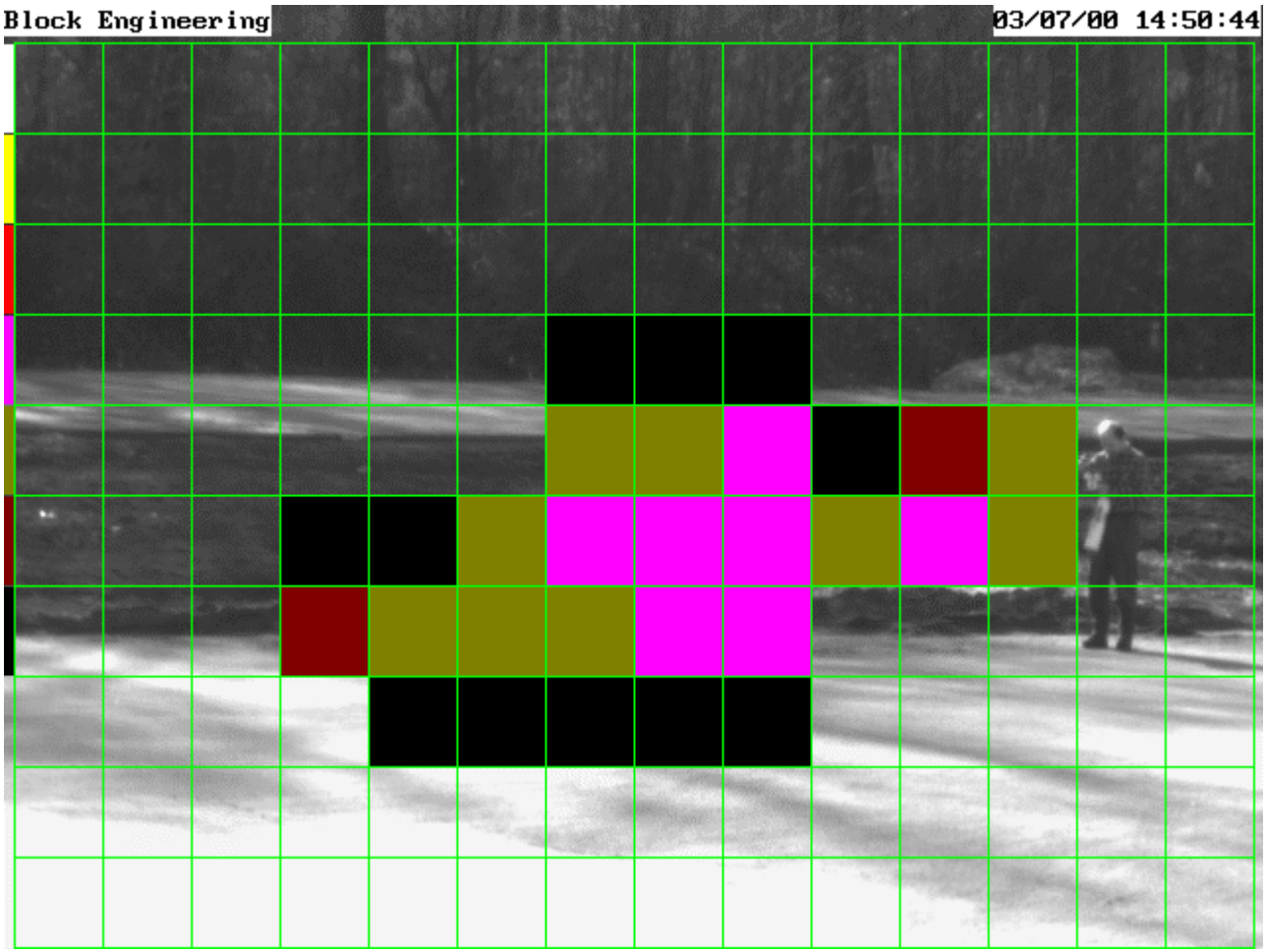


Frames Taken 1 Second Apart; Range 30-50’

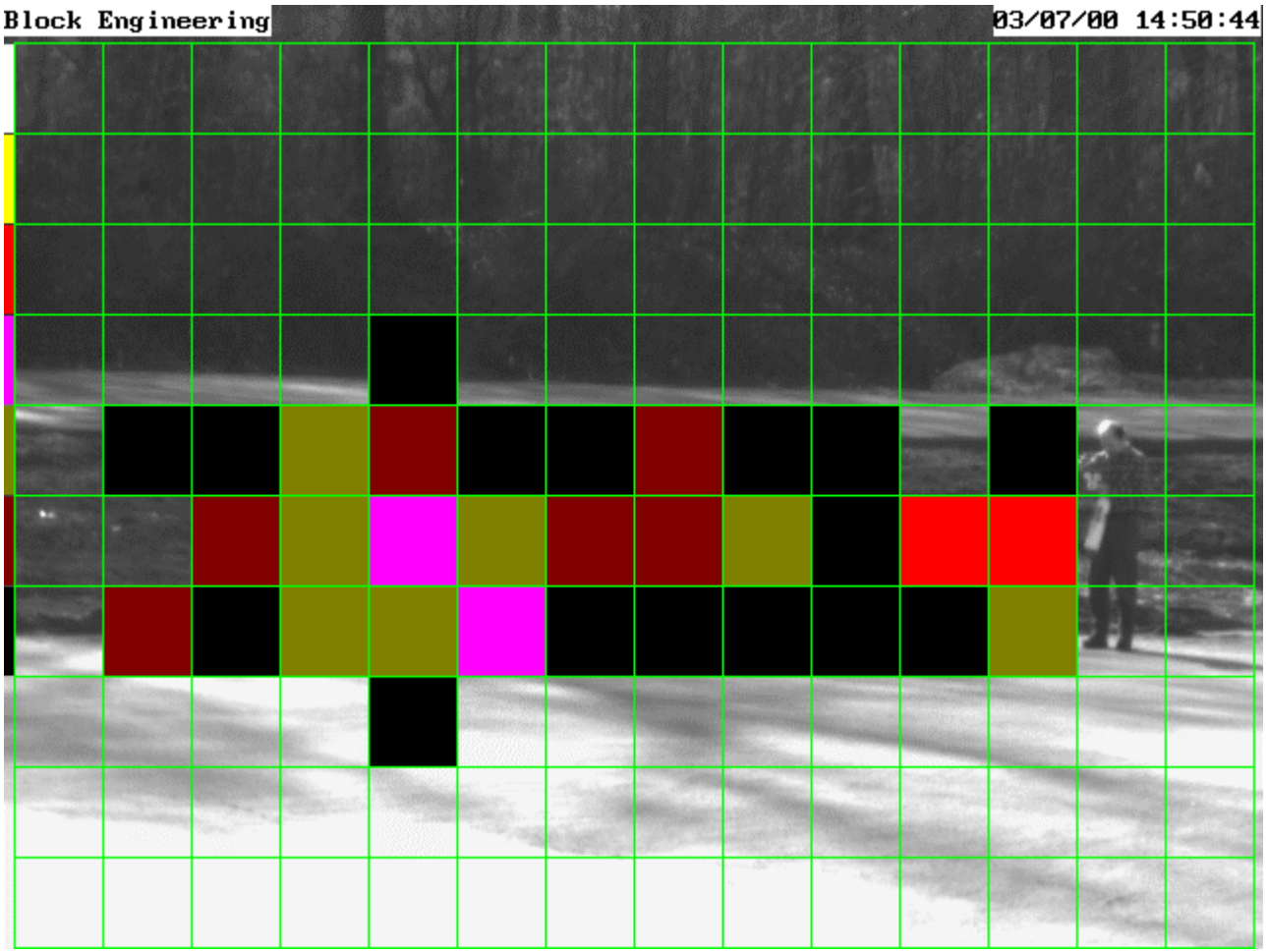



Block Engineering
03/07/00 14:50:44

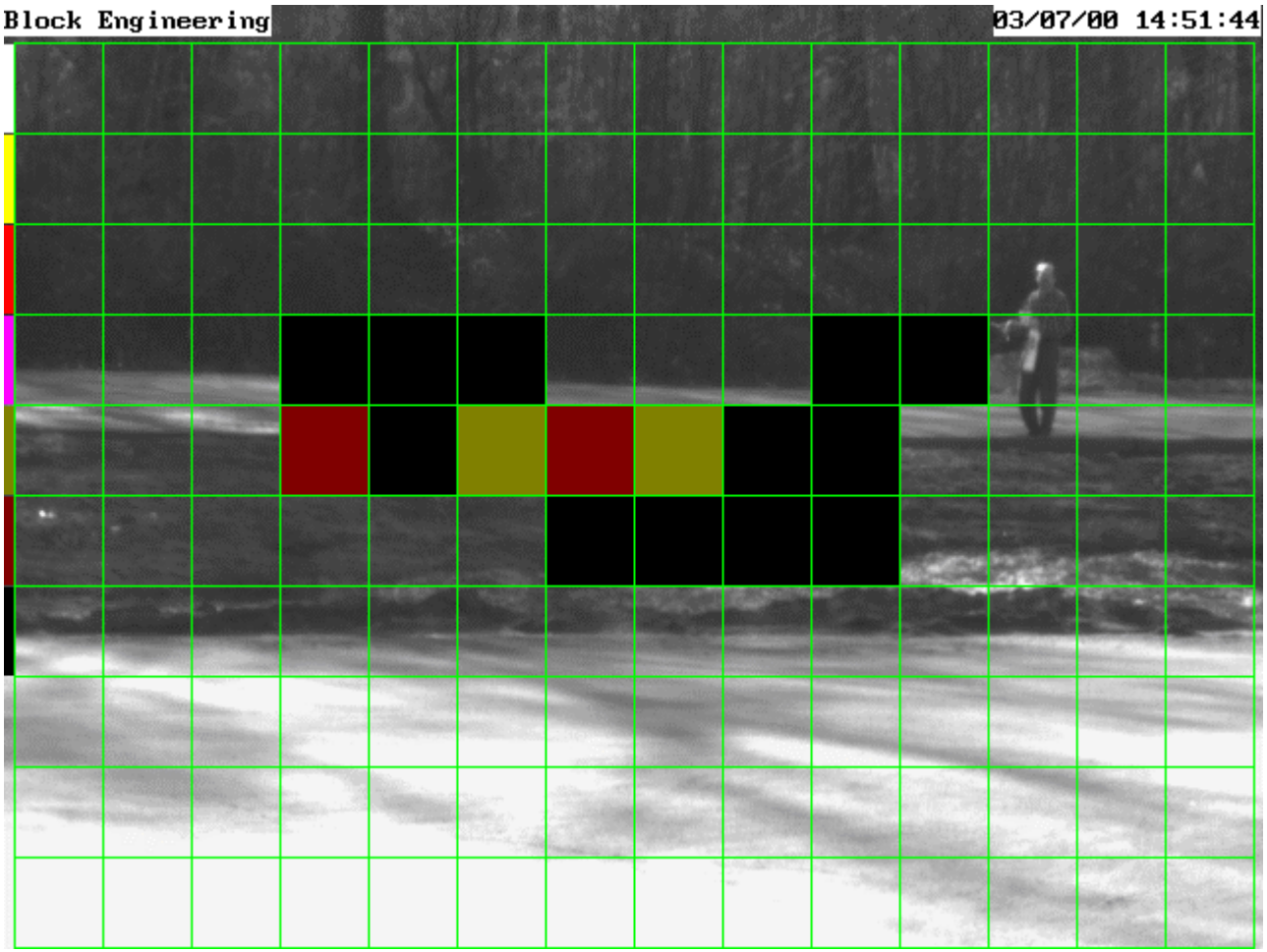

Block Engineering
03/07/00 14:50:44


Block Engineering
03/07/00 14:50:44

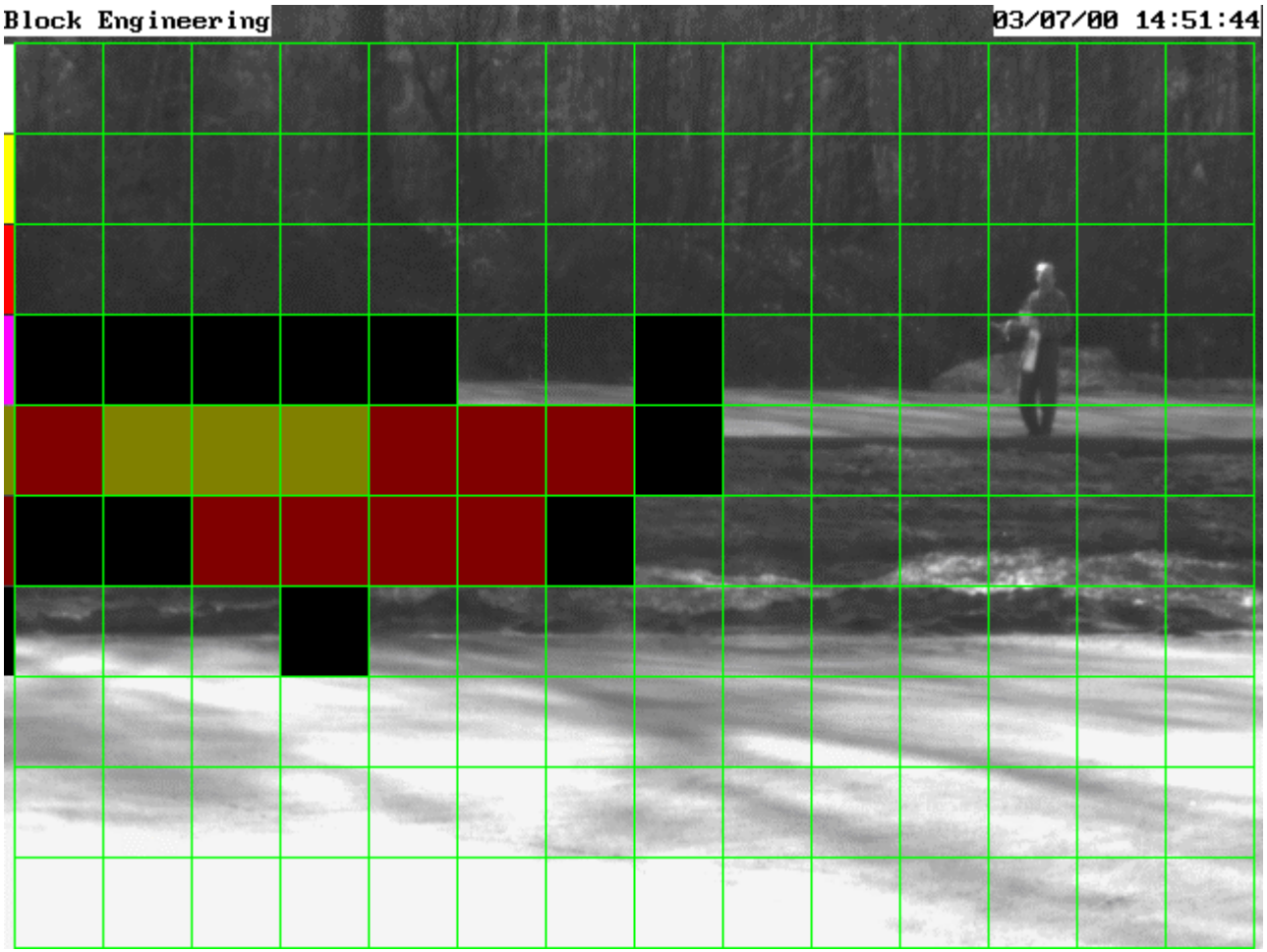
End of First Sequence



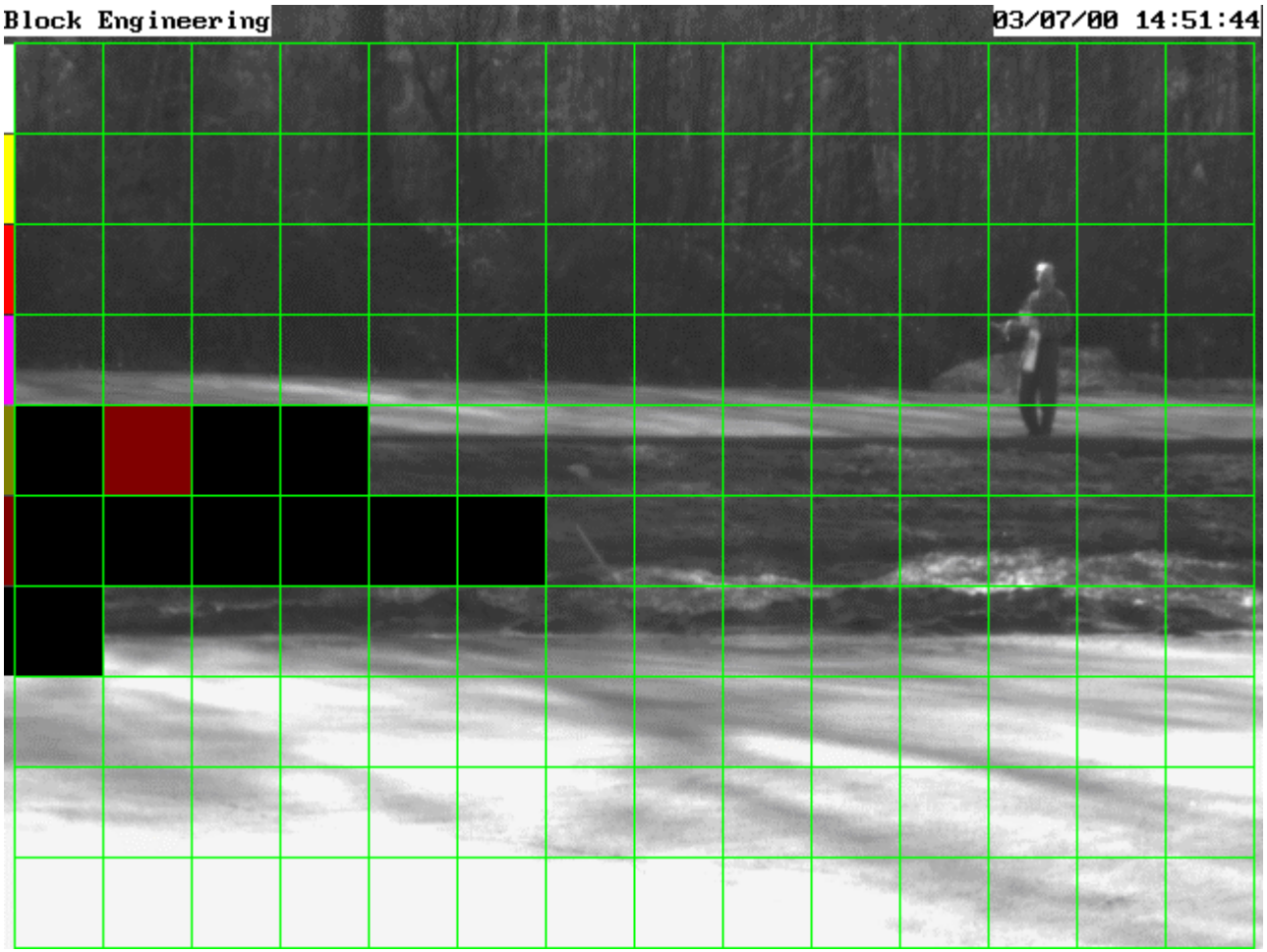
Results of Another Experiment at 75’



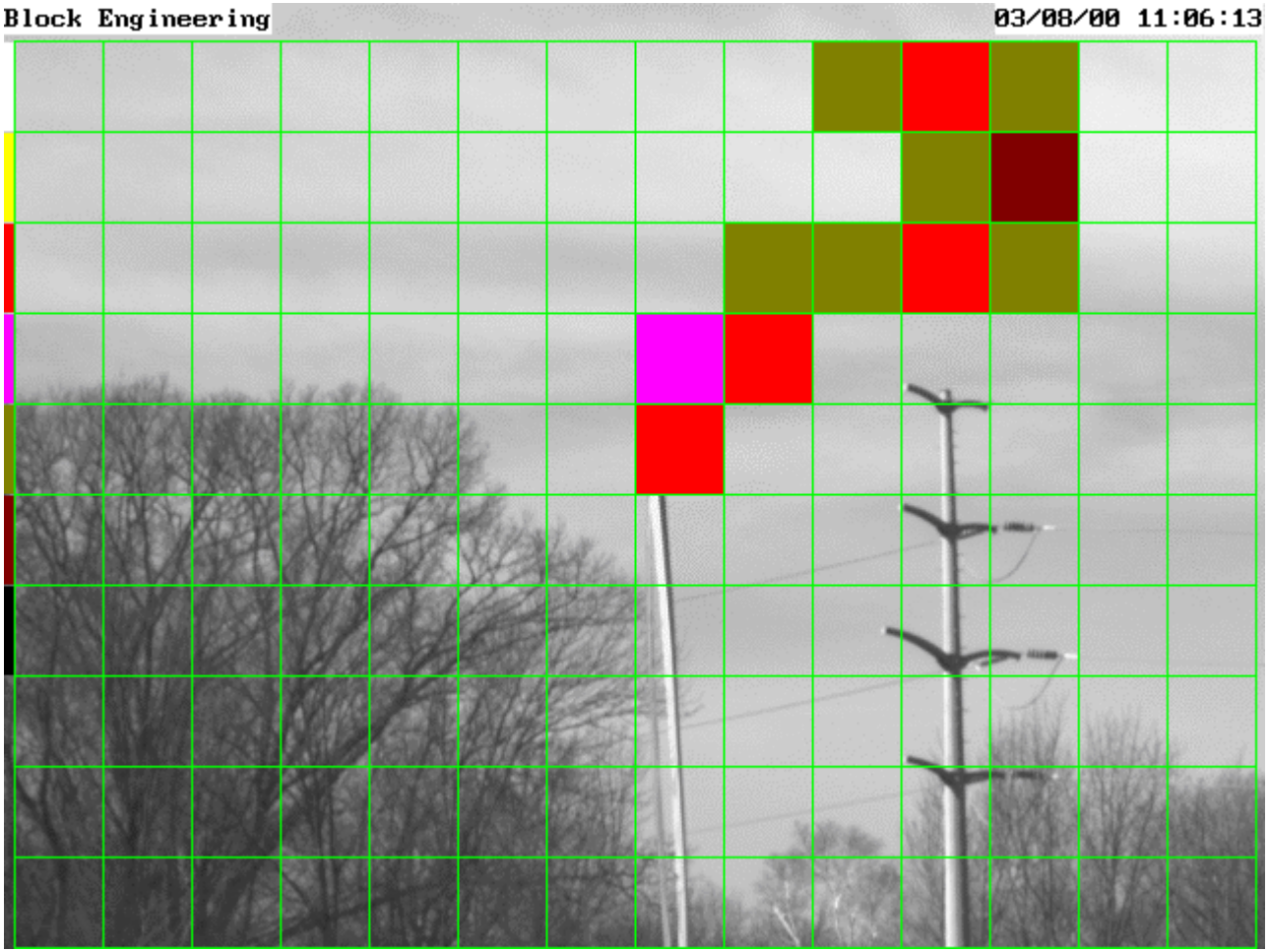
The SF_6 Has Been Shut Off



Cloud Residue Remains Visible

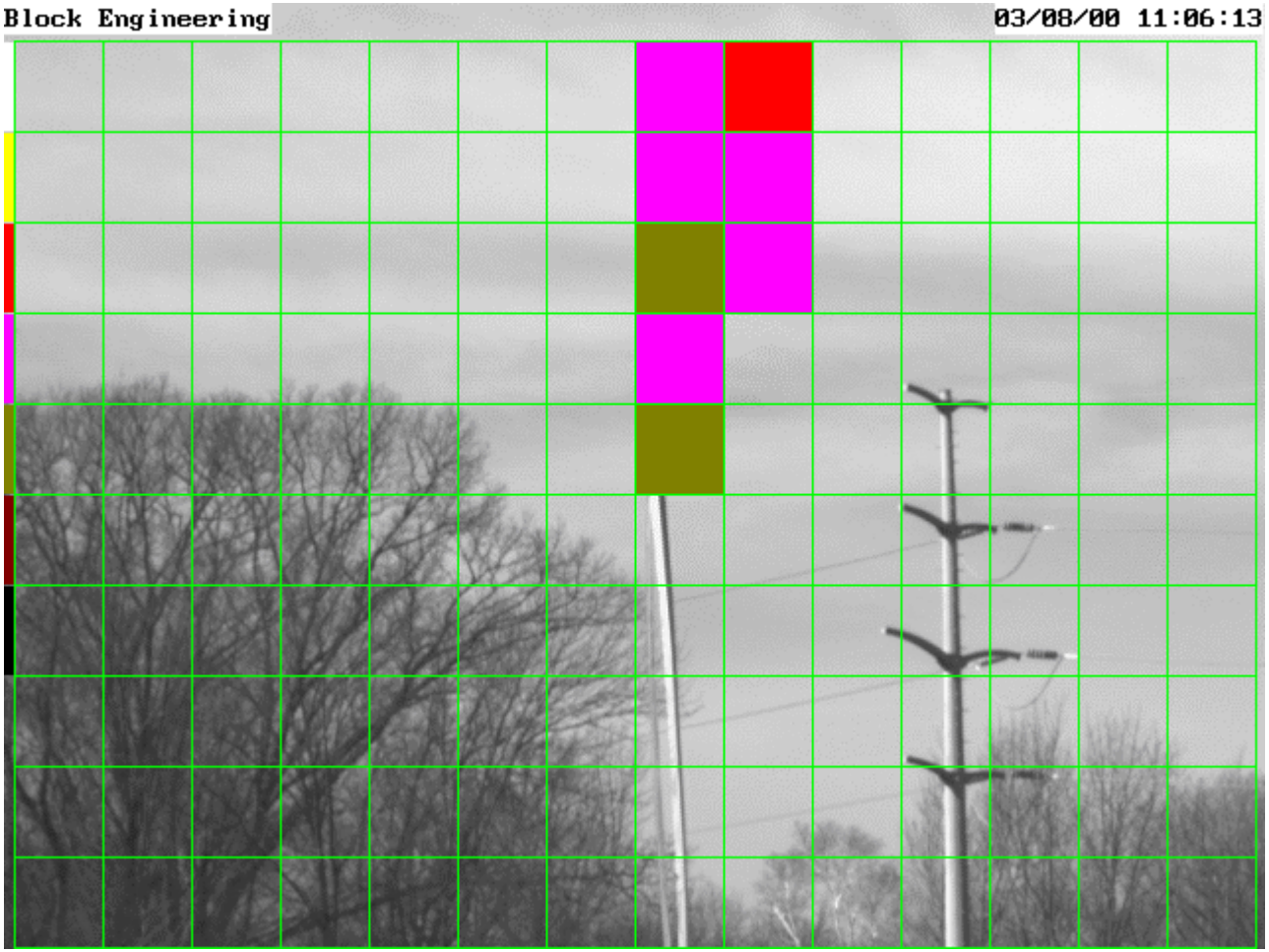


Flow Test at 30-50 Foot Range



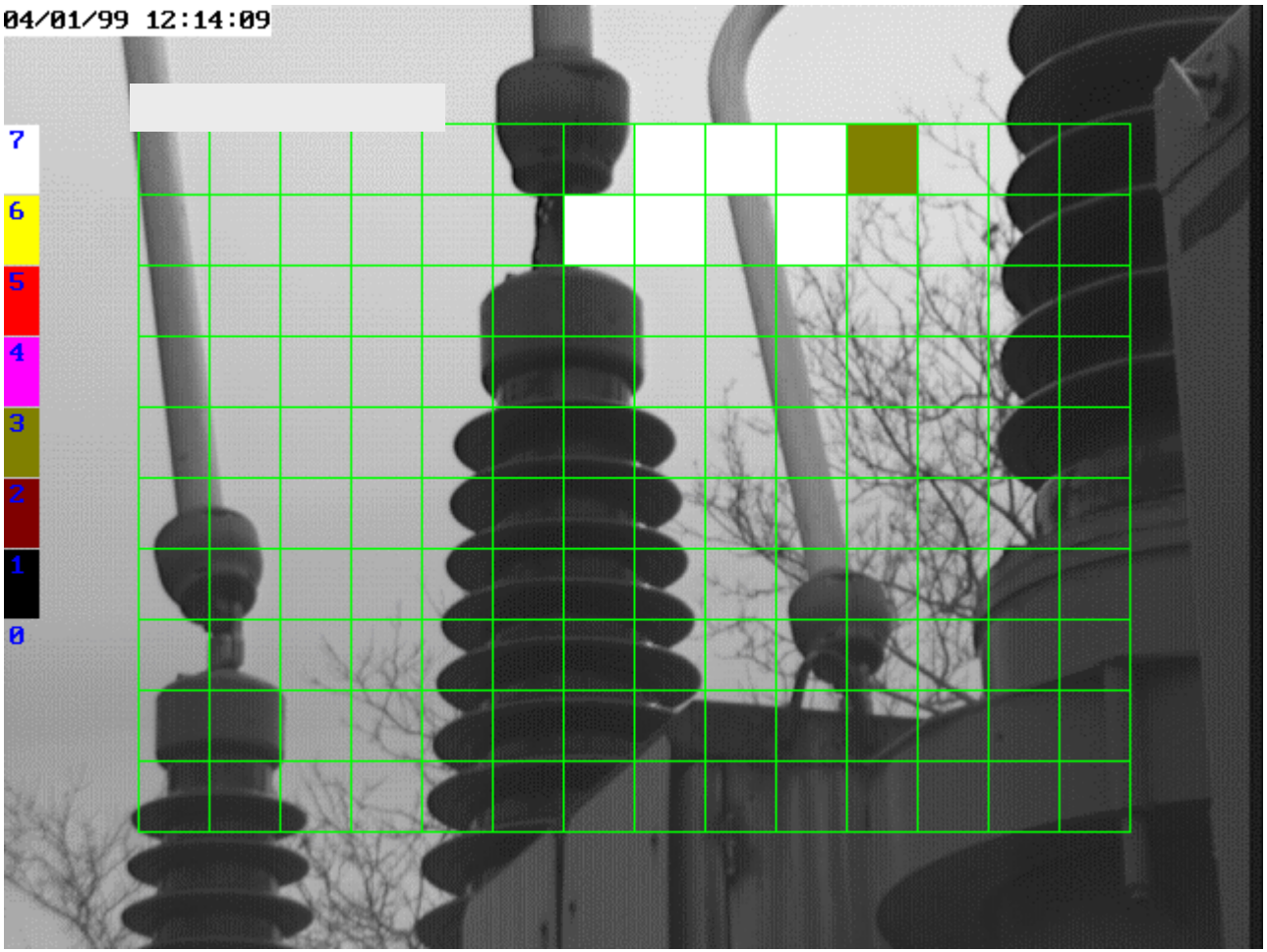
One Second

Flow Test at 30-50 Foot Range

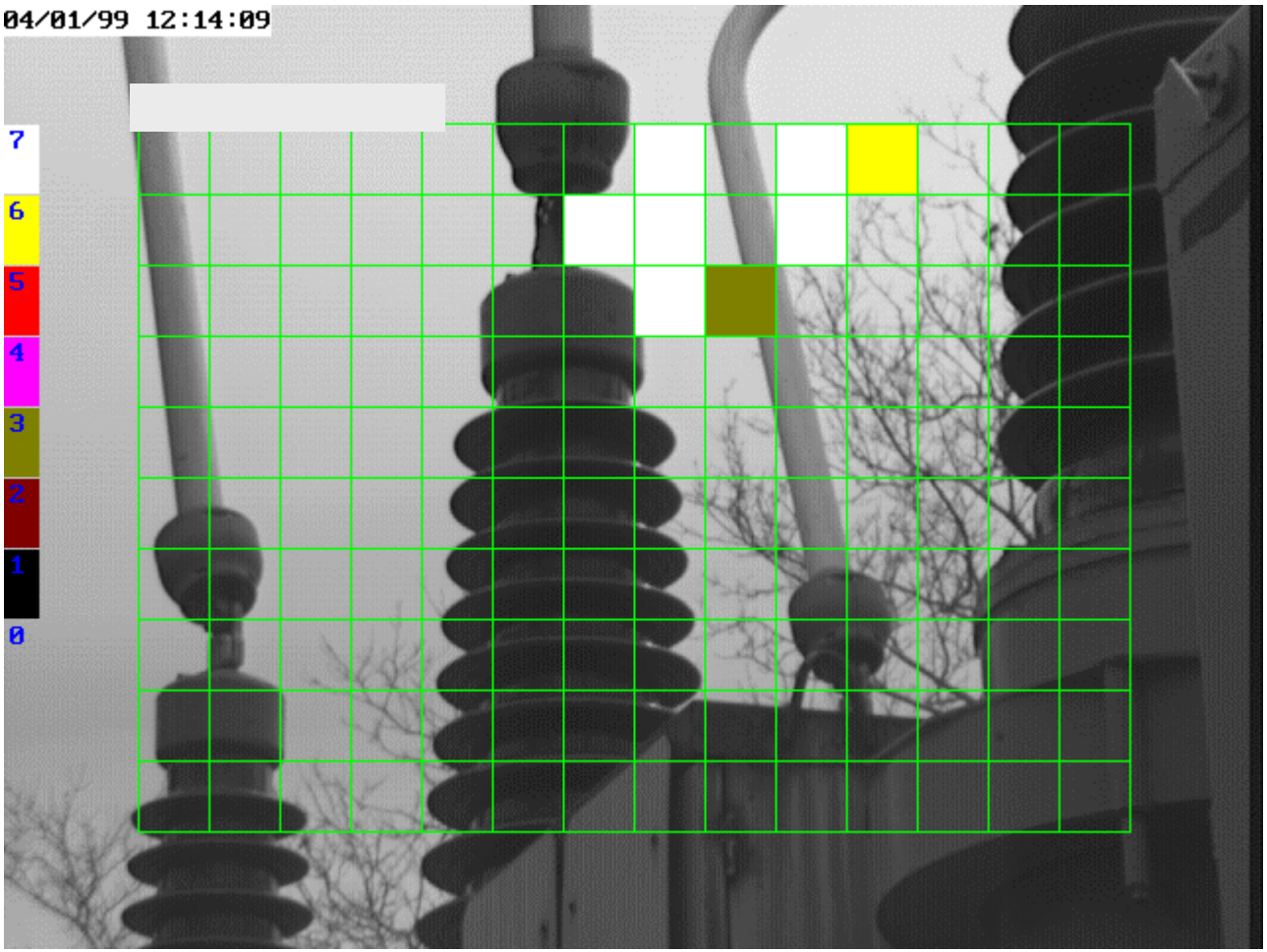


One Second

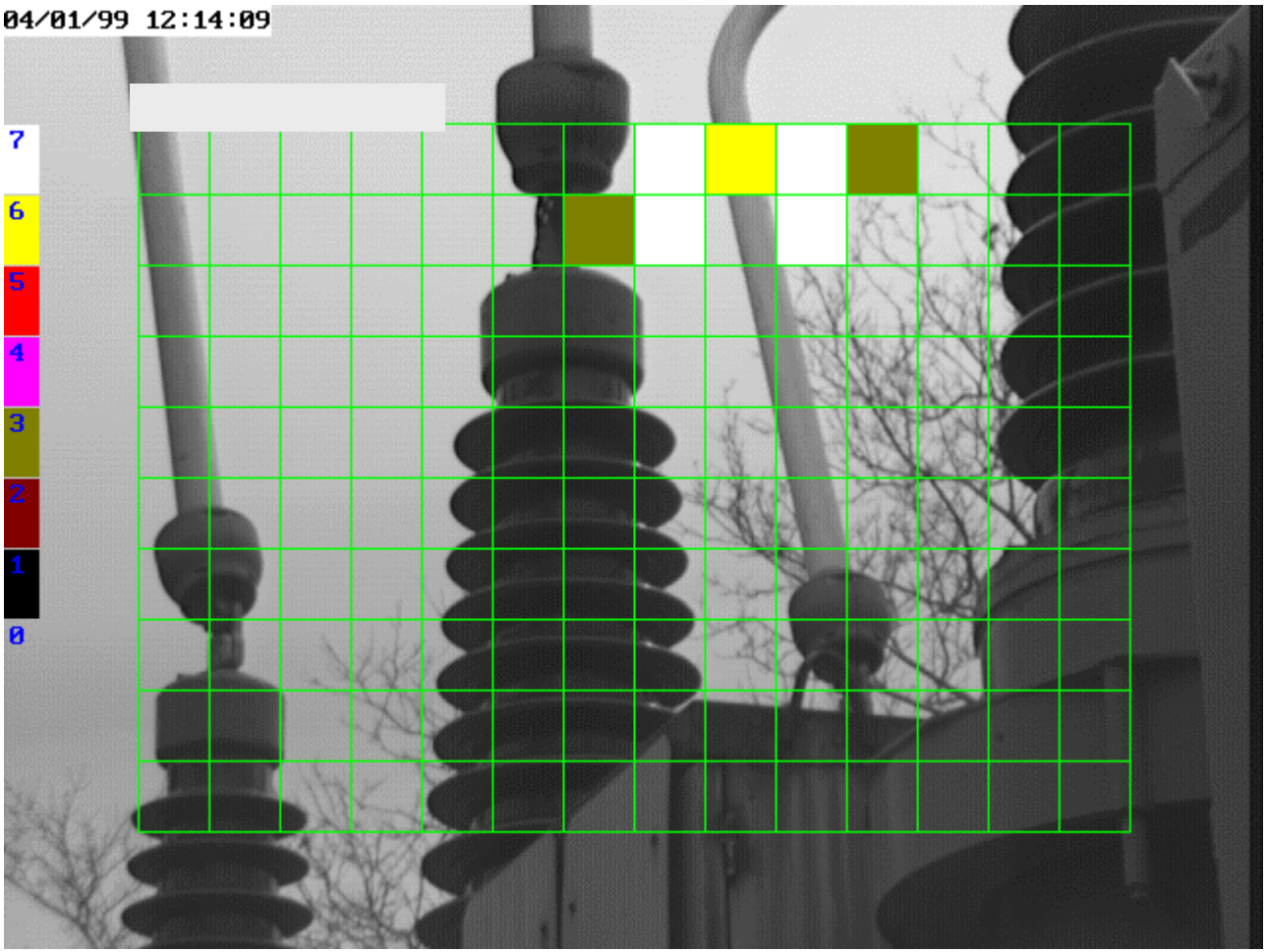
On-Site Data; One Second Run



On-Site Data; One Second Run



On-Site Data; One Second Run



Summary

The I-Spec SF_6 camera has a large field of view and can be used from an over-100-foot range down to 6 feet to further localize leaks

The I-Spec is user friendly, with intuitive leak location and gas concentration display

The I-Spec works against any background including sky, terrain, mechanical equipment

The camera is capable of detecting all IR active gases with minor reprogramming; more than one gas can be detected simultaneously

The I-Spec SF_6 camera is totally passive and therefore completely eyesafe at any range and under all conditions

Present performance indicates that further increases in sensitivity are practical and more automated leak localization can be achieved

Under the recommended use scenario, leaks of SF_6 as small as 1 pound per year can be detected