

BEST PRACTICES GUIDE FOR PERIMETER SECURITY APPLICATIONS

How far can you see with FLIR? This guide explains the fundamental elements of perimeter protection site design with FLIR Security cameras.

WHERE TO START

The fundamental concept of designing a perimeter protection application involves creating a virtual line that separates external from internal areas. In most cases, an intrusion is considered the moment a target crosses the virtual line by moving from an external to an internal area. In some cases, however, it is also necessary to detect targets that are either encroaching on the virtual line or moving within a predefined internal area.

In order to determine design parameters—such as camera placement and height, lenses, and distances—several calculations are required to ensure that the following terms are met:

1. There must be sufficient coverage across the virtual line to eliminate all “dead-zones” where a potential target is not fully covered by a surveillance camera’s field of view
2. Target size validation must meet the performance criteria required by a given camera’s video analytics, from the nearest to the most distant points covered by each of the cameras along the fence line

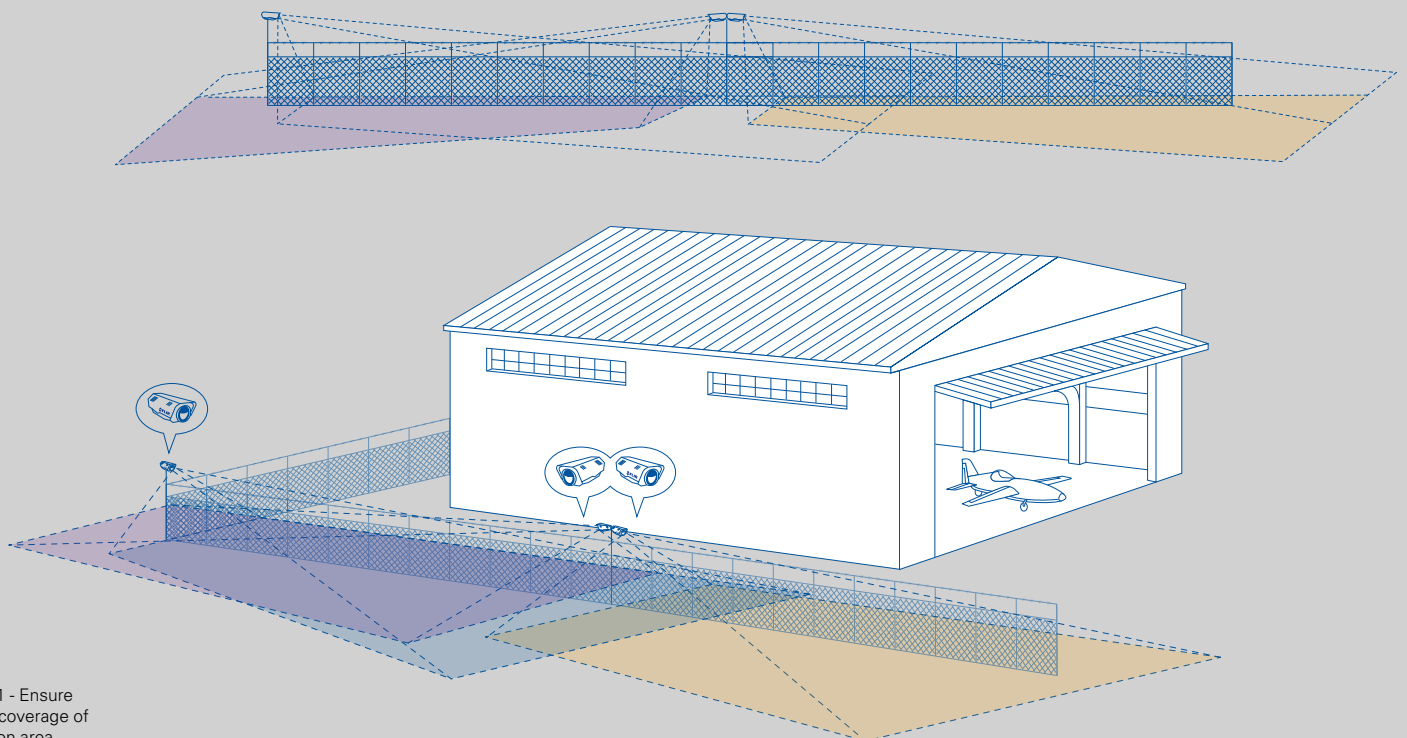


Figure 1 - Ensure proper coverage of detection area

Various tradeoffs apply between target size and coverage. Generally, widening the camera's coverage results in smaller targets across the field of view. Therefore, the best way to start is with the application requirements:

- Does the application require detection or recognition? Must it distinguish between humans and vehicles?

- What are the key alarm scenarios? Should an alert trigger when a target crosses the virtual line or when it simply approaches it?
- Do I favor performance over costs? The probability of detection increases when more cameras are used and allow for overlapping coverage. On the other hand, it is possible to use fewer cameras and still guarantee high performance, most of the time

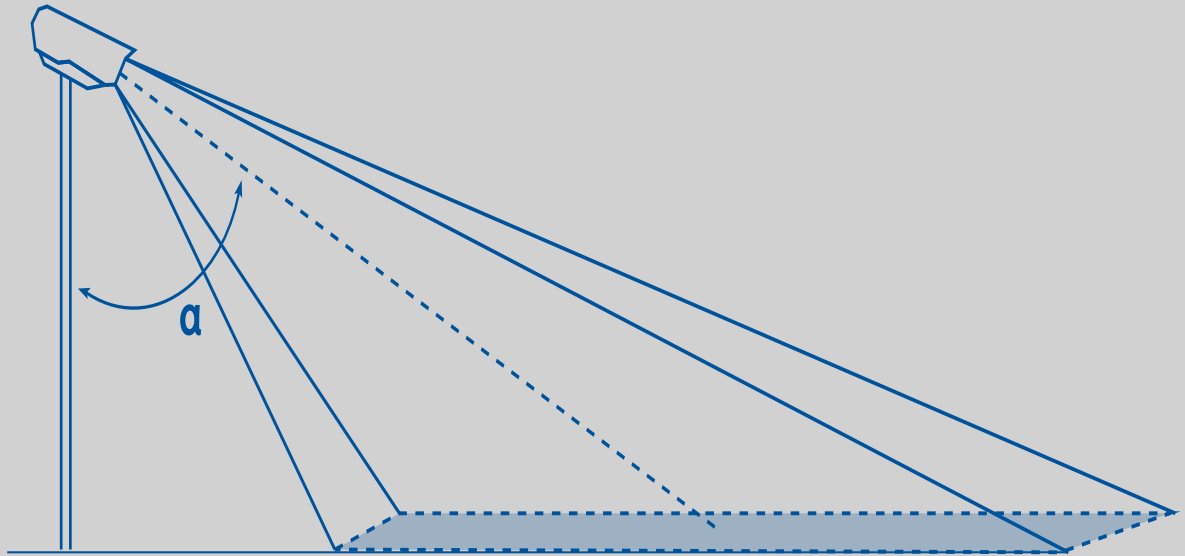


Figure 2

CAMERA PLACEMENT

When determining camera placement, there are several ways to achieve optimal area coverage and fence line protection. Best practices consider the specific perimeter layout, application requirements, and site topology. However, in most cases, optimal performance and efficiency are achieved by placing cameras so that their fields of view run parallel to the fence line and perpendicular to the movement of potential intruders approaching or crossing the perimeter.

Within the camera's field of view, the highest probability of detection and the lowest rate of false alarms are achieved when targets move horizontally from one side of the camera image to the other. The following are considered best practices for camera positioning to ensure full camera coverage across the perimeter.

- Install the camera at a height of 4 meters (13 ft) or more
- Use a steep "look down" angle that will leave out as much sky from the camera's field of view as possible.
- For installations with multiple cameras, the fields of view of cameras should overlap in order to remove all dead zones in which a camera cannot see a target "head to toe"
- For optimal performance, position cameras so their fields of view run parallel to the fence line and perpendicular to intruder movement, rather than directing them so they will face approaching targets
- When determining the camera positioning, consider whether you only need to detect the moment of intrusion or when a target simply approaches an area
- Make sure that cameras are mounted on stable poles with minimal vibrations and maximal resistance to wind.

INCORRECT CAMERA PLACEMENT

Security hole allows intruder to approach without head-to-toe visual needed for proper size classification and detection

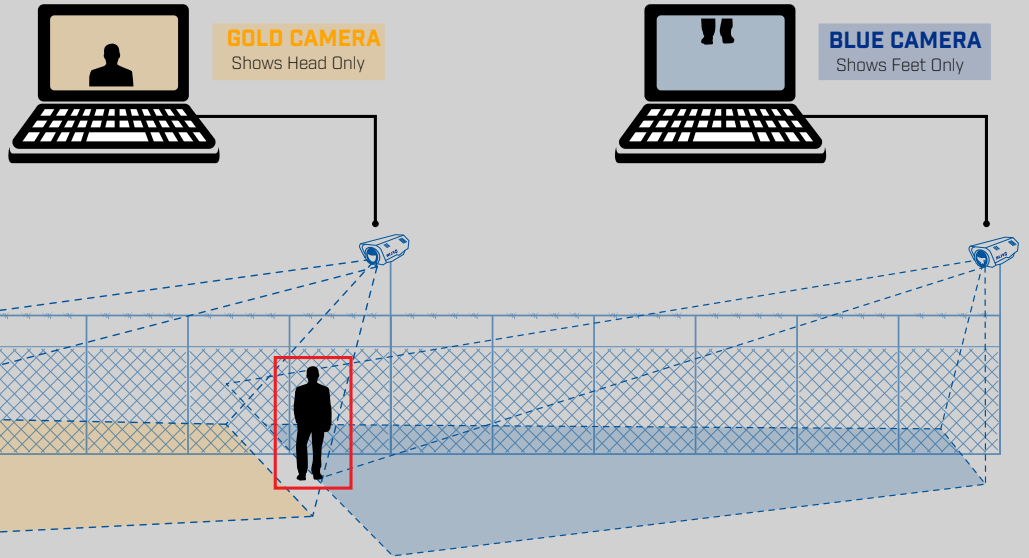


Figure 3

CORRECT CAMERA PLACEMENT

The overlapping coverage does not leave gaps where an intruder can enter without being seen head-to-toe

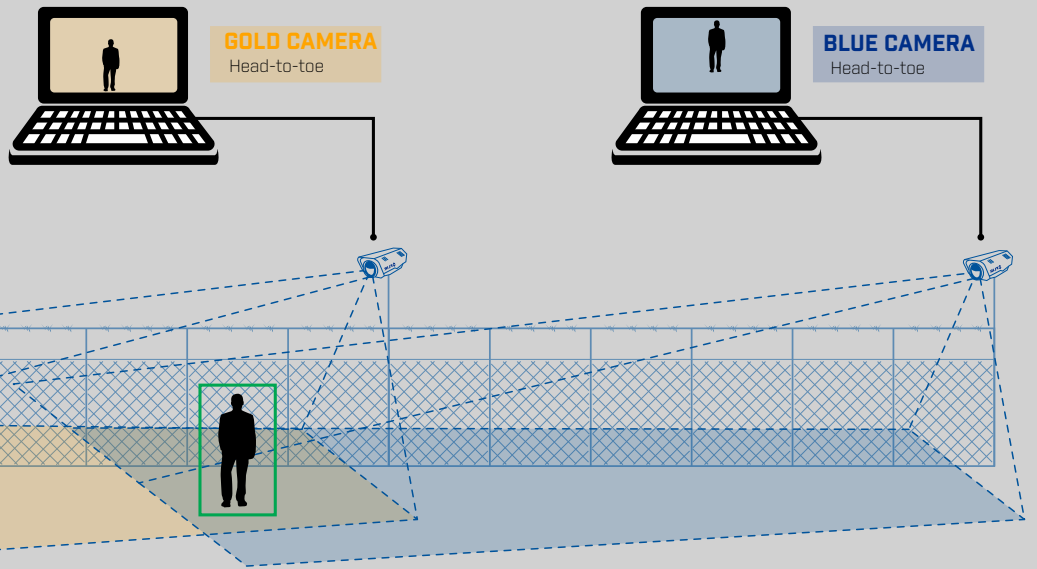


Figure 4

CHOOSING THE RIGHT LENS

The main consideration when choosing a lens is its focal length, which has a significant impact on both the camera's field of view and target size. Greater focal length increases the magnification of objects in the field of view, such that they are represented by a larger number of pixels. In other words, greater focal length means larger targets for video analytics, resulting with greater detection distance. See figure 5.

On the other hand, the correlation of focal length and field of view is exactly the opposite: the smaller the focal length, the wider the field of view. See figure 6. This means that when choosing the proper lens, one needs to consider the trade-off between detection distances and the width of the scene. In most cases, the best practice is to define the minimal requirement for scene width and choose the largest available focal length to meet the width criteria.

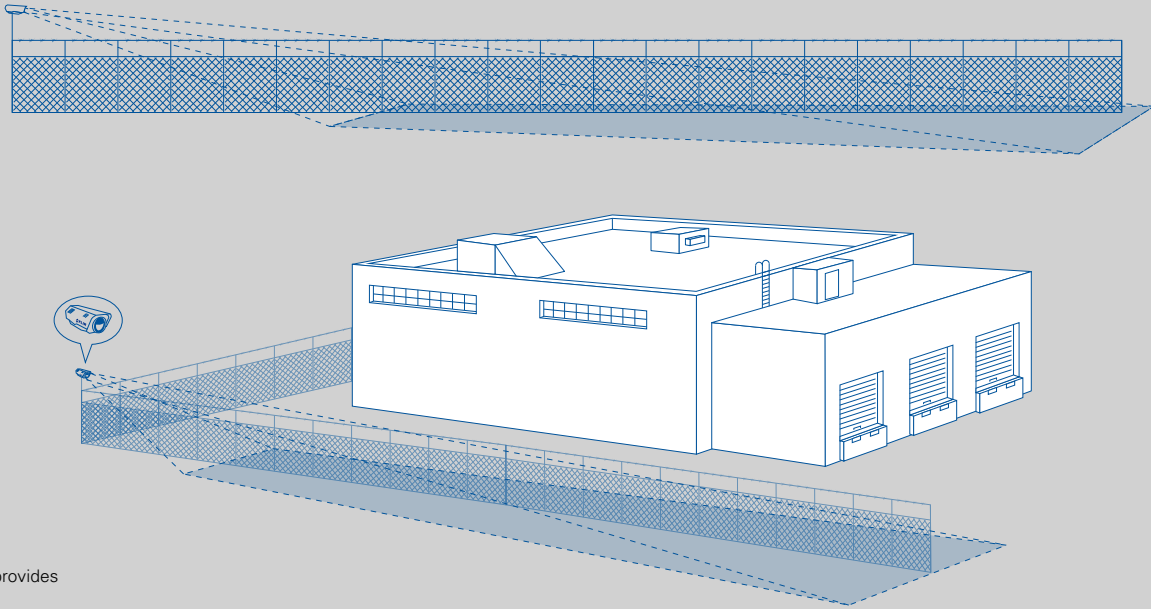


Figure 5 - Narrow lens provides greater distance

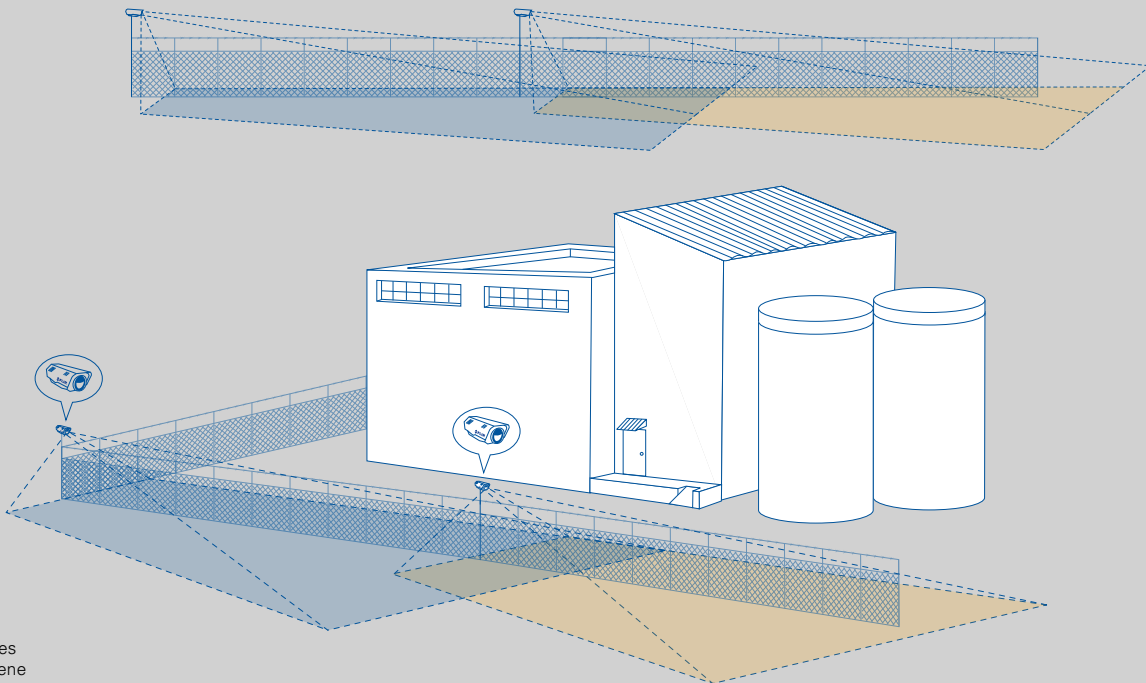


Figure 6 - Wide lens provides shorter distance / wider scene

TARGET SIZE AND DETECTION RANGE

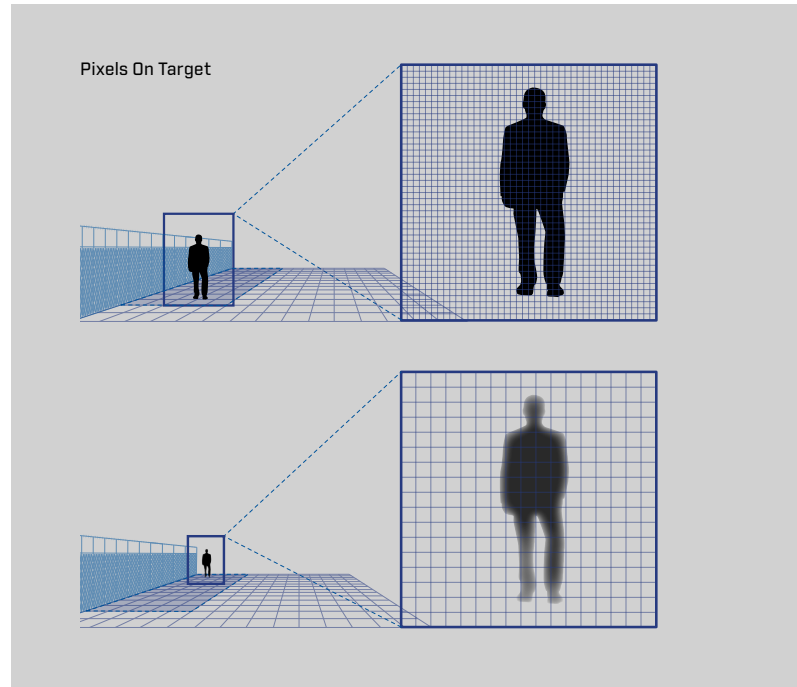
Target size is a term used to calculate the maximal distance a FLIR camera with built-in analytics can detect a target. This distance is also referred as "detection range."

Target size is determined by the number of pixels representing the target within the camera image, and is also known as "Pixels On Target" (POT). Other than the target size, which is the critical factor, detection

range criteria also depends on a large number of environmental and system variables, including the background temperature (hot desert versus cold snow) and atmospheric conditions (clear skies versus fog). Both directly influence the scene's contrast level; the visibility of the target; and the ability to understand the nature of the target (moving vehicle vs. crawling human), its speed, and movement.

For this reason, determining detection ranges should be treated as a statistical evaluation that takes these additional factors into account. As a best practice, the following formula is provided to calculate the detection range under optimal conditions where implicating factors do not negatively impact the performance of the built-in video analytics' detection range. In other words, detection under optimal conditions reflects the maximal achievable distance in practical scenarios.

In addition to detection, the formula can be used to calculate classification ranges under optimal conditions. The difference between detection and classification is that while detection results with alarms that are triggered by either human or vehicle targets, classification allows one to distinguish between the two, and configure the system such that it will generate an alarm for specific types of targets, while ignoring others.



Using current satellite imagery, the Raven Site Planning Tool allows users to simulate the placement of FLIR cameras in highly accurate, coordinate-controlled locations.

RAVEN SITE PLANNING TOOL

FLIR offers an online, easy-to-use product planning tool called Raven that is a convenient way to calculate the target size / POT for any given FLIR thermal camera model at any given distance. Determine the detection or classification range based on the maximal distance where the detection or classification criteria are met.

Target size (meter)	Required Pixels on Target for Detection (Optimal conditions)	Required Pixels on Target for Classification (Optimal conditions)
Human (0.5 x 1.8)	3 x 9.5	4 x 13.5
Vehicle (5.0 x 1.5)	23 x 6.5	30 x 8.5

PTZ AUTONOMOUS TRACKING

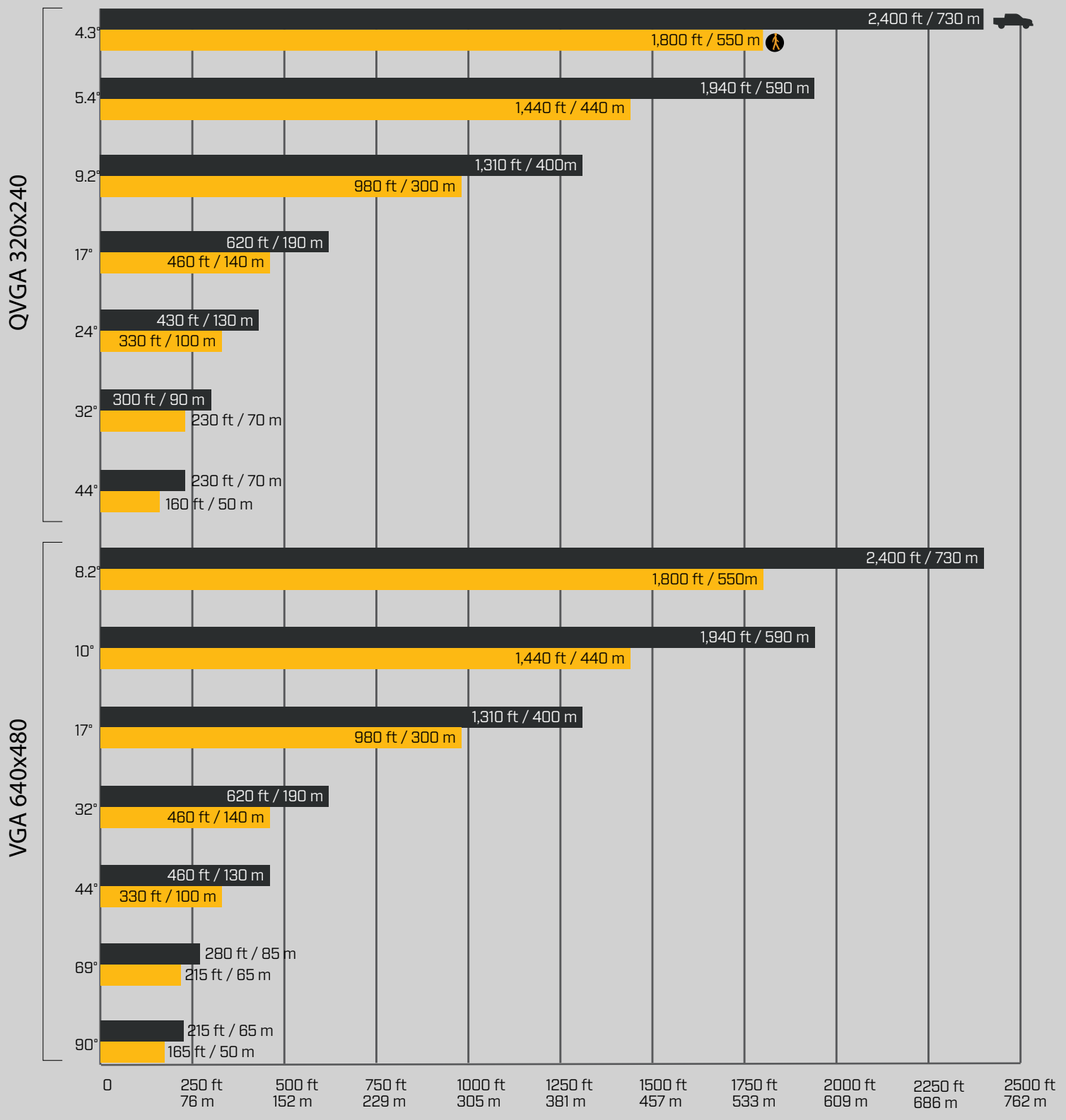
PTZ tracking is a family of applications that enable autonomous target tracking by motorized Pan-Tilt-Zoom cameras, allowing continuous video capturing while the target remains within the range of the deployed PTZ cameras. FLIR PTZ tracking can be configured to work in one of the following modes (or a combination of both): "Pattern mode" allows for the configuration of a PTZ preset pattern tour that allows the PTZ camera to detect targets on presets within a preconfigured pattern and auto-track targets once they are detected. By comparison, "hand-off" mode enables the fixed camera to notify the nearest PTZ camera when it detects target is detected so that the PTZ camera will locate and auto-track the target. This mode is sometimes also referred to as "PTZ target handoff."

CAMERA MOUNTING RECOMMENDATIONS

To obtain reliable PTZ tracking, it is essential to mount the camera at heights that allow for the detection of distant targets. Generally, the higher the camera is mounted, the longer its detection range. If a target is not within the detection range, PTZ tracking will not initiate. Thermal PTZ cameras should be mounted at a height of no less than four meters (13 ft), and ideally eight meters (26 ft) above the ground. The camera angle for PTZ tracking remains the same as for regular detection. The camera should be angled down so that as little sky appears in the field of view as possible.

The following table can be used as a quick reference for FC-Series ID camera line detection and classification distances.

CLASSIFICATION RANGE

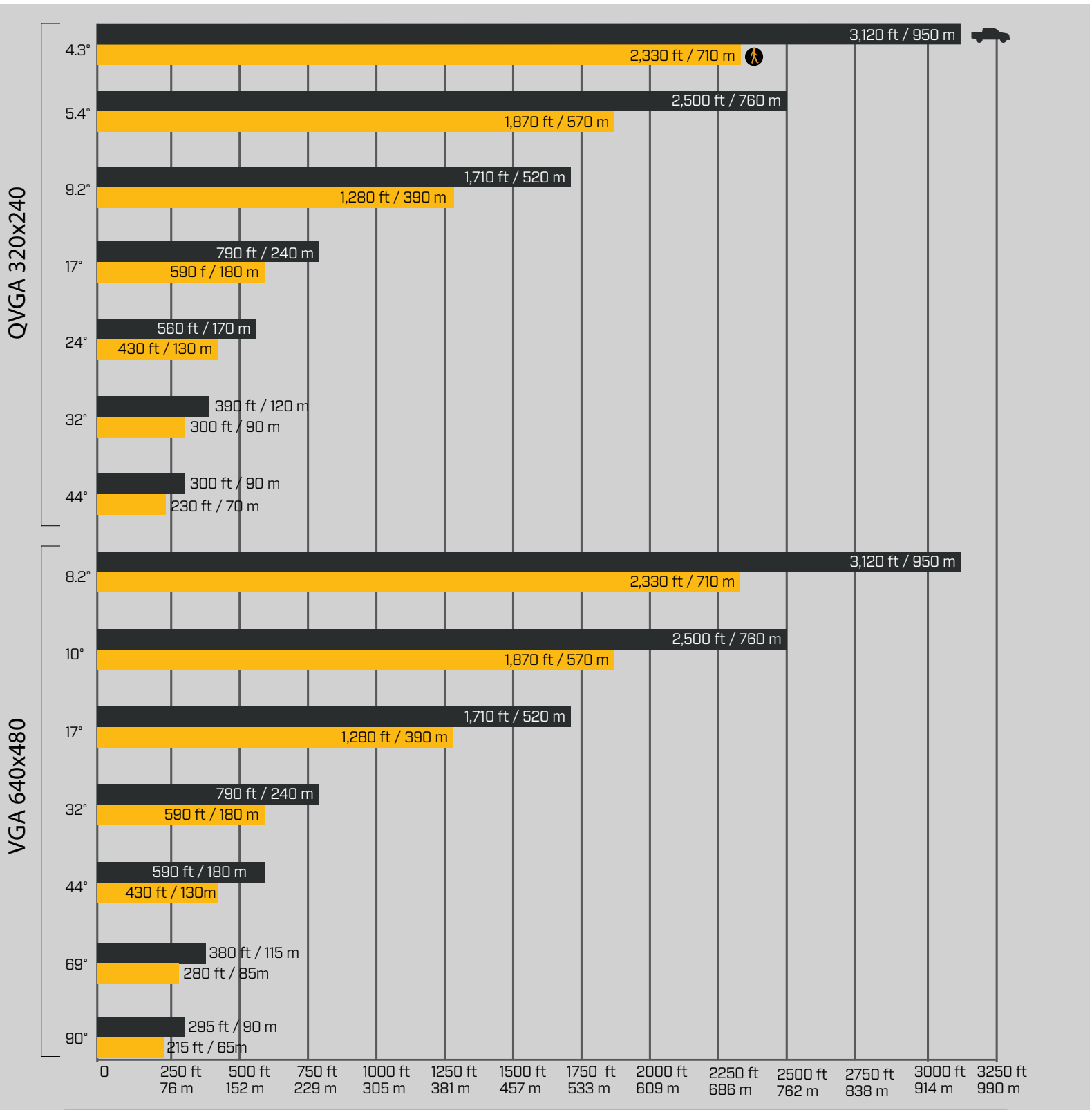


Based on calculated distances and field testing. Distances may vary depending on environmental conditions.

For project design refer to official product specifications

■ Vehicle ■ Person

DETECTION RANGE



Based on calculated distances and field testing. Distances may vary depending on environmental conditions.

For project design refer to official product specifications

■ Vehicle ■ Person

PORTLAND

Corporate Headquarters
FLIR Systems, Inc.
27700 SW Parkway Ave.
Wilsonville, OR 97070
USA
PH: +1 866.477.3687

Santa Barbara
FLIR Systems, Inc.
6769 Hollister Ave,
Goleta, CA 93117

NEW JERSEY

FLIR Systems, Inc.
65 Challenger Rd
Ridgefield Pk., NJ 07660
PH: +1 201.708.9816

EUROPE

FLIR Systems
Luxemburgstraat 2
2321 Meer
Belgium
PH: +32 (0) 3665 5100

CANADA

FLIR Systems, Ltd.
920 Sheldon Court
Burlington, ON L7L 5L6
Canada
PH: +1 800.613.0507

CHINA

FLIR Systems Co., Ltd
Rm 1613-16, Tower II
Grand Central Plaza
13B Shatin Rural
Committee Road Shatin
New Territories
Hong Kong
PH: +852 2792 8955

LATIN AMERICA

FLIR Systems Brasil
Av. Antonio Bardella, 320
Sorocaba, SP 18052-852
Brasil
PH: +55 15 3238 7080

www.flir.com/security
NASDAQ: FLIR

Equipment described herein may require US Government authorization for export purposes. Diversion contrary to US law is prohibited. Imagery for illustration purposes only. Specifications are subject to change without notice. ©2020 FLIR Systems, Inc. All rights reserved. (Rev 01-20) 19-2965-SEC



The World's **Sixth Sense**®