FOSM
Fiber Optic Security Mesh

The unique foolproof−accurate−nuisance alarm free perimeter intrusion detection system by means of skin concept protection

- **Zero nuisance alarm being immune to environmental effects**

- **100% foolproof detection of intrusion**

- **Pinpoint the intrusion spot with ±15m (±3m possible)**

- **Negligible Maintenance**

- **Unlimitedly applicable to fence, wall, gate, drainage, buried, underwater etc.**

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The purpose of **PIDS** (Perimeter Intrusion Detection System) is to surely detect any possible intrusion which may happen very rare but likely by highly skilled terrorist like Al-Qaeda. The facilities buy the PIDS not only to absolutely protect from intrusion but also to have peace in mind like when buying an insurance. Ir-reliable PIDS that does not guarantee to alarm at actual intrusion or put out nuisance alarms is actually of no security effect to have the site remain vulnerable to intrusion and waste money.

There exist about forty intrusion sensors over the world which can be classified as vibration sensor, EM (Electro-Magnetic) field sensor and taut wire sensor. Vibration sensors are mounted to fence fabric and detect cutting through fence fabric but unable to detect climbing over from a shoulder /ladder without touching the fence fabric and put out numerous nuisance alarms seriously being affected by wind, rain, flying debris, animals, thunder, moving vehicles etc., or loose/deteriorate sensitivity at bad weather and harsh terrain condition.

EM field sensors also put out numerous nuisance alarms or loose/deteriorate sensitivity being seriously affected by wind, rain, haze, trees, animals, lightning, power lines etc. Taut Wire sensors are not free from nuisance alarming being intrinsically affected by terrain condition and storm, thunder, moving vehicles and expose a number of weaknesses due to which the system be vulnerable to defeat by intruder.

FOSM (Fiber Optic Security Mesh) is reputed as the unique foolproof – accurate – nuisance alarm free to comply with the purpose of PIDS overcoming the weakness and limitation of other types of sensors .

FOSM (Fiber Optic Security Mesh) operates based on Optical Radar Technology. The system injects Infrared Laser pulses into FOM (Fiber Optic Mesh) to identify intrusion from the presence of abnormal Optical echoes caused by either intruder cutting or excess force and pinpoints the intrusion spot on the monitor with audible & visible alarm at Security Control Center.
The fundamental technologies of FOSM was invented by Dr. Youn Bae in 1982 while serving as a researcher at Korea Agency for Defense Development (ADD) and later far upgraded gradually to the current level of commercial version by Fibertron Co., Ltd. . over 40 years.

Throughout worldwide installations at eminent facilities such as Korean Nuclear Power Plants, Airports, Oil&Gas Reservoirs, Korea Presidential House, Singapore Ministry of Defense, ISTANA, Kuwait MoFA, Saudi Palace/MODA, Fibertron's FOSM has gained its reputation as marvelous product performing as :

●Zero nuisance alarm due to the environmental effects
●100% fool-proof detection of intrusion
●Pinpoint the intrusion location with $\pm$ 15 meter typically ($\pm$ 3 meter possible)
●Negligible Maintenance
●Versatile application
●Accept IR Sensors at the Main Gate

Refer to **SaudiMoDcerti.pdf** and **KoreaBHcerti.pdf** for the field performance report.Upon receiving order from the customer site, Fibertron teamed with their partner/agent is prepared to construct the system to put the site under foolproof protection to comply with the purpose of PIDS.
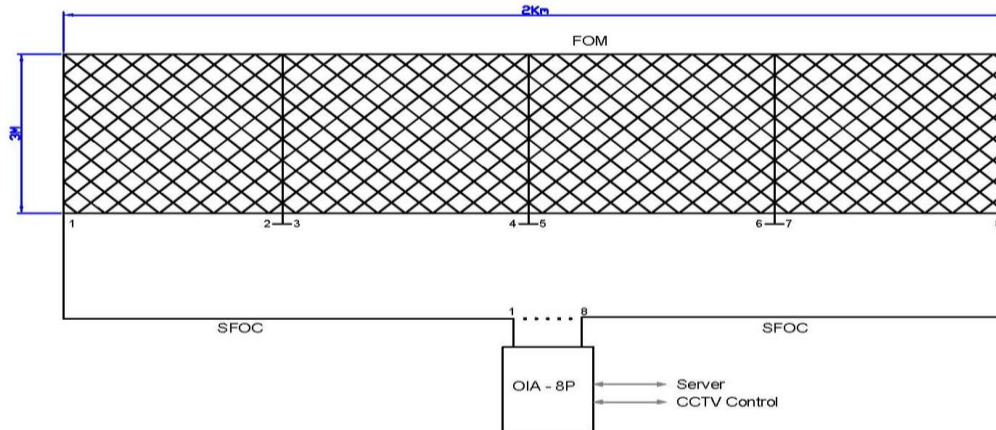
Normal

Optical Fiber
Optical Pulses
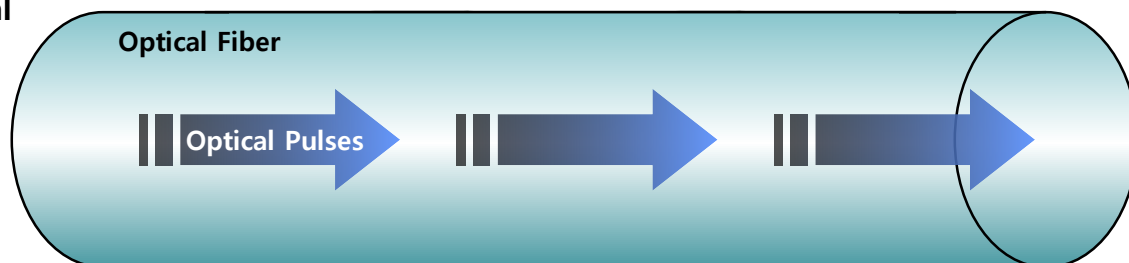
Intrusion

Cutting or Excessive Force
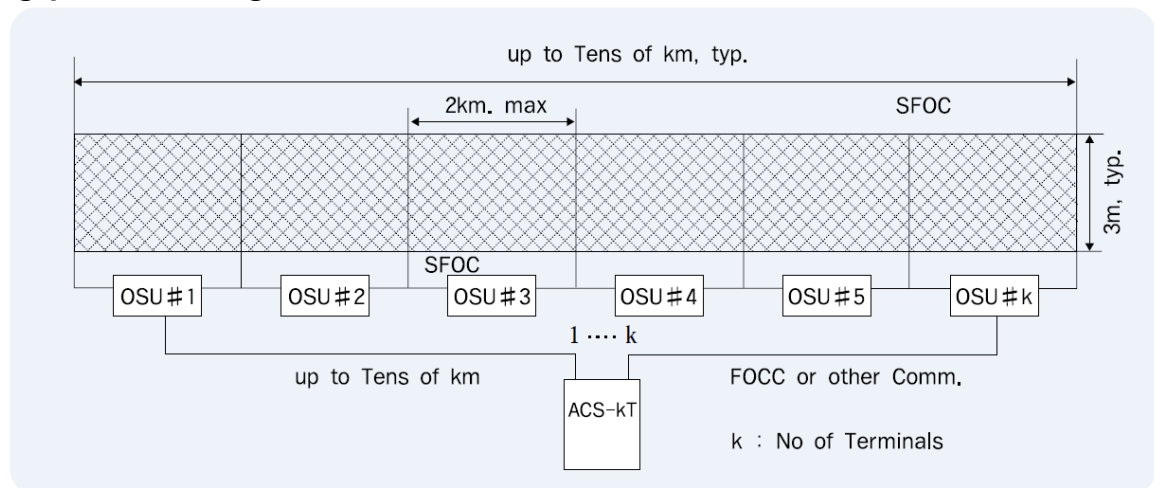

Optical Pulses
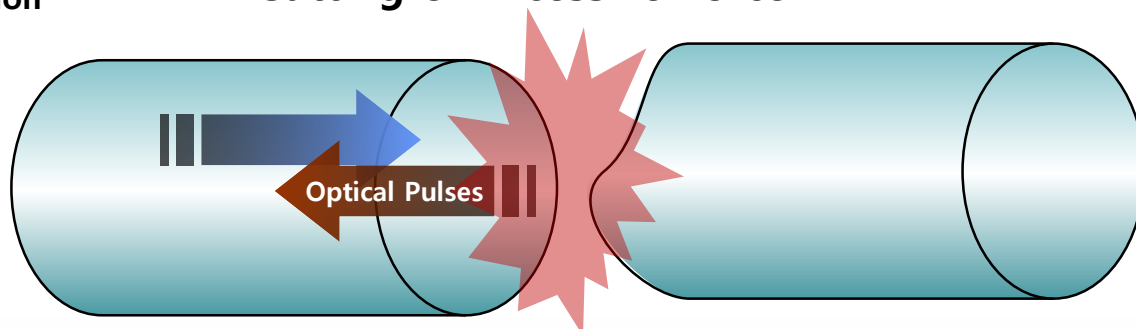
The System Configuration

Along short perimeter less than 2km, OIA alone

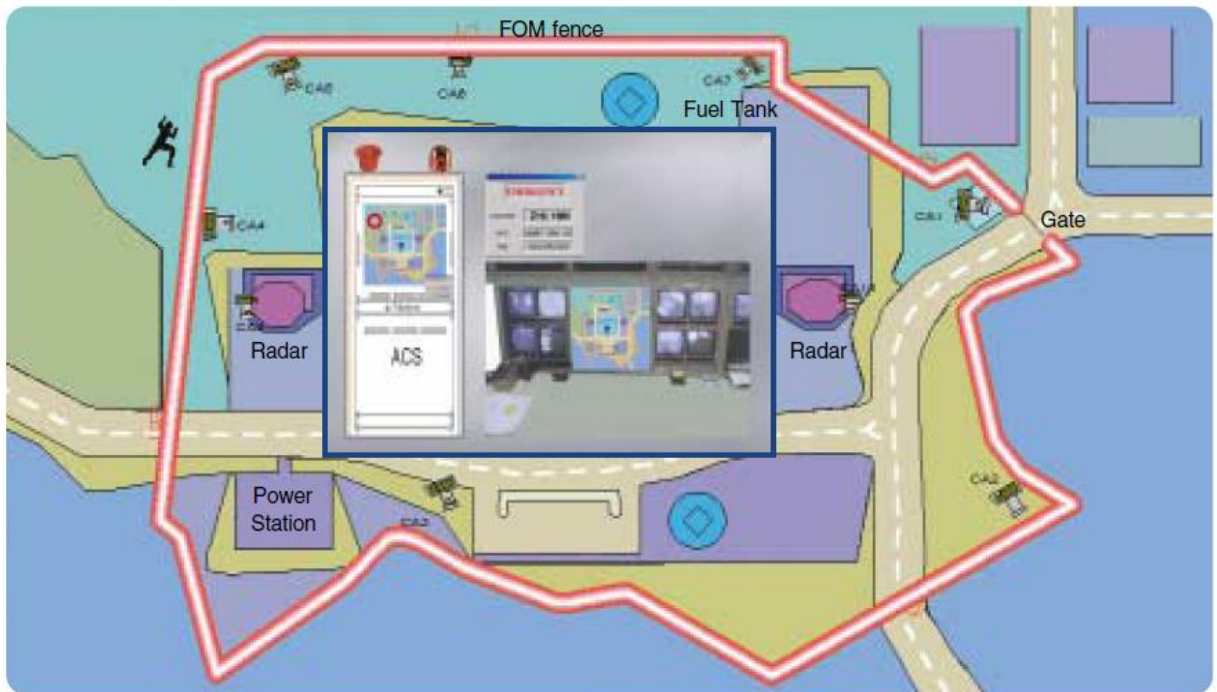### Along perimeter larger than 2km, ACS & OSU

The System Description

- A perimeter as large as 2.5km x 3m can be controlled by an ACS at the SCC (Security Control Center) or an OIA (Optical Intrusion Alarm) . A larger area can be protected by a number of OSUs each covering an area of 2.5km x 3m, connected to and controlled by an ACS at MCC via FOCC (Fiber Optic Control Cable) remotely.

- OIA is a compact desk-top version of ACS. ACS, OIA or OSU can be interfaced with CCTV to automatically detect the intrusion spot and be interfaced with Warning or Access Control and be communicated and integrated with other servers.

- The system is virtually false alarm free because of (1) immunity to all kinds of environmental effects such as water, electricity, vibration, neighbors as well as atmospheric temperature and (2) a negligible amount of electronic equipment outdoors which is affected by water, electricity and temperature.

- The system is applicable unlimitedly to fence type and ground condition : (1) overlaid to existing fences, (2) overlaid to gate (3) over wall (4) Standing-free and (5) Underwater diver detection.

- Intrusion by digging below the fence can be prevented or detected by Grooved Rods, which are fixed to FOM and stuck underground. Pulling out grooved rods shall force FOM bottom to trigger alarm.

- FOM is installed on the top and bottom of the fence frames with TT (Top Transducer), CF (Concrete Fixture) etc.

- For an open gate, field sensors (IR Sensors) can be placed and also controlled by ACS which replaces the field sensors' existing controllers.

- Broken FOM can be repaired using commercial splicing tools in either direct repair or column replacement without any difficulty.

Intrusion Alarm & Display

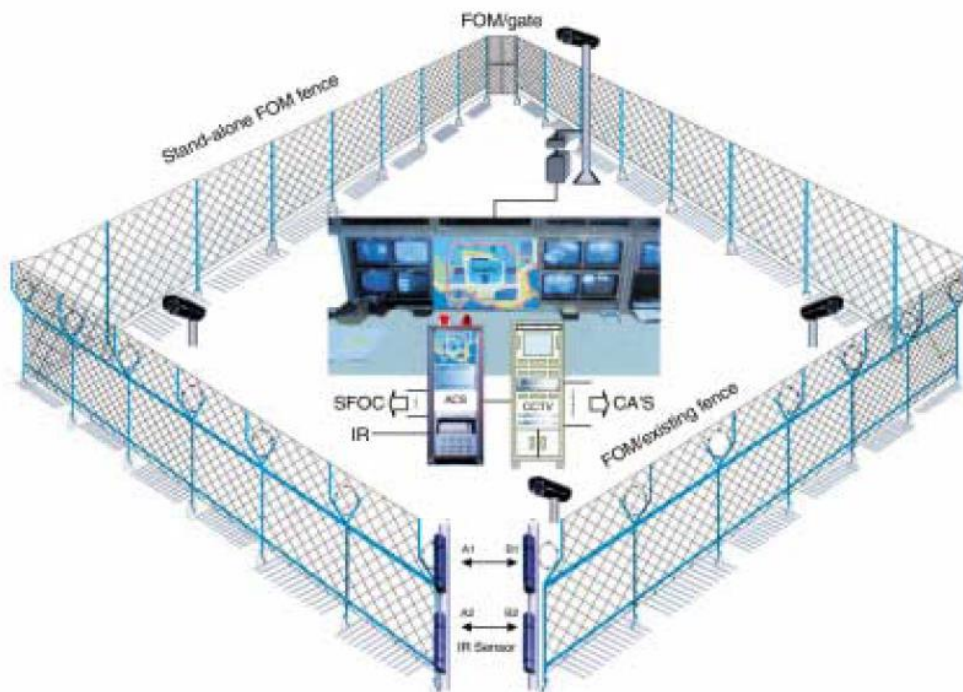**Log File Display by ACS**

The intrusion alarm and event data Shall be automatically recorded in the system memory

OTDR Display by ACS

ACS can display OTDR pattern of FOM to check optical loss/fault/break.

Skin & Eyes Concept Protection

Control Equipments

The ACS is the intelligent main unit which receives the presence of the abnormal Optical echoes from OSU and processes it to identify and pinpoint on monitor with visible and audible alarms. There are two different models. ACS-nP houses an OSU-nP in the same rack. ACS-kT is to control k OSUs at separate remote location. ACS also provides OTDR service function and operation data storage. ACS provides input ports for other sensors such as IR Sensor, Shock Sensor, Door Locks etc and communication ports with other PC, CCTV Control, Server PC, LAN, Internet etc

ACS(Alarm Control Station)

◆ **ACS-nP/kT (Alarm Control Station)**
• Operation mode : Normal, Test, Emergency,Setting,Stop
• Sensing mode : cutting and/or excess force
• Location Accuracy : ±1m , ±15m , ±25m, Optional
• No of Optical ports : n (upto 8)
• No of terminals : k OSUs (upto 64 typical)
• External connection port : PC interface
• Fiber Optic test function : semi-OTDR
• Auto-logging : alarm, action, status, setting value etc
• Monitor : 17" color
• Interface : dry contacts, serial or LAN
• Acceptable output devices : warning light, signal phone
• Acceptable input devices : IR/MW sensor, shock sensor
• O/S : Window 7/10
• Dimension : 195 x 60 x 75cm or 150 x 60 x 75cm
• Operating condition : indoors
• Power : AC220V±10% 50/60Hz, 400Watt approx

ACS – nP

ACS – kT

The OSU injects infrared Laser Pulses into the FOM and measures any optical echoes to pick up any external disturbances. The OSU transmit abnormal symptom data to the Alarm Control Station to process and trigger an alarm. The OSU is either housed within ACS-nP or remotely at the site.

OSU (Optical Sensing Unit)

◆ **OSU-nP (Optical Sensing Unit)**
• No of Optical Ports : n (upto 8)
• Sensing coverage per Optical port : 3m x 250m for break,   3m x 200m for excess force stronger than 20kg
• Fiber Optic connector type : FC multi-mode
• Dimension : 177×483×300 mm
• Weight : 10 kg, typical
• Operating condition : indoors, inside shelter for outdoors
• Power : AC220V±10% 50/60Hz, 250Watt

OIA-nP is a PC body size desktop version of ACS-nP. OIA injects Infrared Laser Pulses to the FOSC (Fiber Optic Sensor Cable) periodically and shall identify & accurately locate the presence of intrusion from the abnormal Optical Echoes to trigger an alarm visibly & audibly operators. OIA also provides OTDR service function and operation data storage. ACS provides input ports for other sensors such as IR Sensor, Shock Sensor, Door Locks etc and communication ports with other PC, CCTV Control, Server PC, LAN, Internet etc.

OIA (Optical Intrusion Alarm)

◆ **OIA-nP (Optical Sensing Unit)**
• Operation mode : Normal, Test, Emergency, Setting, Stop
• Sensing mode : cutting and/or excess force
• Location Accuracy : ±1m , ±15m , ±25m, Optional
• No of Optical Ports : n (maximum 8)
• Sensing mode : cutting , excess force , selectable
• External connection port : PC interface
• Fiber Optic test function : semi-OTDR
• Auto-logging : event data (alarm,action,status,setting value etc)
• Monitor : 8.4" LCD color built in or 17" LCD external
• Interface : dry contacts, serial or LAN
• Acceptable output devices : warning light, signal phone
• O/S : Window 7/10
• Dimension : 19" 4U (177×483×300 mm)
• Operating condition : indoors
• Power : AC220V±10% 50/60Hz, 100Watt approx

FOSM

Fig.1 FOM overlaid to Fence
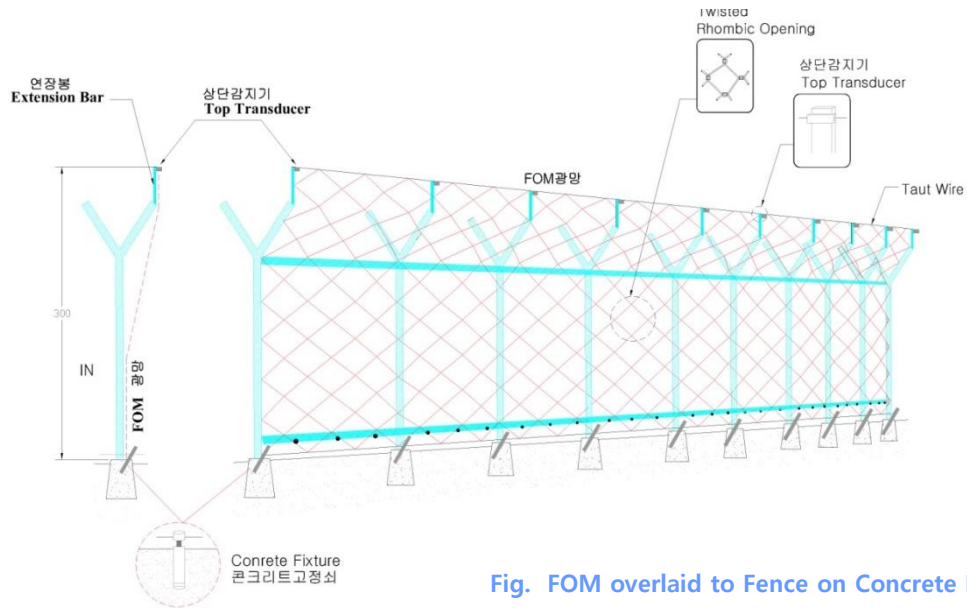
Fig. FOM overlaid to Fence on Concrete Foundation

FOM (Fiber Optic Mesh) Description

The FOM is woven with Fiber Optic Sensor Cable (FOSC) in a twisted rhombic shape to stretch or shrink to be suited slight fence height /length variation and to remain in the twisted rhombiic cell structure even after removing a cell fastener.

Highly flexible insulation (high grade polyurethane) is used to make the cable to allow a bending radius of less than 10mm (typically single core tight buffered fiber offers a bending radius of about 30mm) enabling it to be extra flexible and easy to manage on site.

The flexible nature shall cater to make it hardier for rough handling and less prone to internal fiber breakage, which occurs in other fiber system.

FOM bottom can be fixed to Concrete Fixtures and/or Grooved Rods so as to prevent or sense intruder by underneath crawling or shallow digging.

Climbing over the fence can be detected by Taut Wire coupled with FOSC at either TT (Top Transducer) on FOM top or FOSS (Fiber Optic Stress Sensor) mounted to concertina coil.

Model : FOM- HM
• The cable diameter/color : 3mm/black
• Optical Fiber grade : 125μm multimode
• FOM width (height) : H meter (3 meter typically)
• Cell size : 90-120cm in woven rhombic shape
• Operating temperature : -40℃ + 75℃
• Cell fastener : SUS304/Prevent opening using commercial hand-powered tools
• Environmental characteristic: Immune to all kind of environment effects such as water (rain, snow, haze etc)/electricity (lightening, electrostatic, ground loop, power line, EMI, RF etc)/ sound & vibration (wind, storm, sound. vehicle vibration etc)
• Weight < 40kg / 3m x 100m

Fig.2 FOM & FOSS
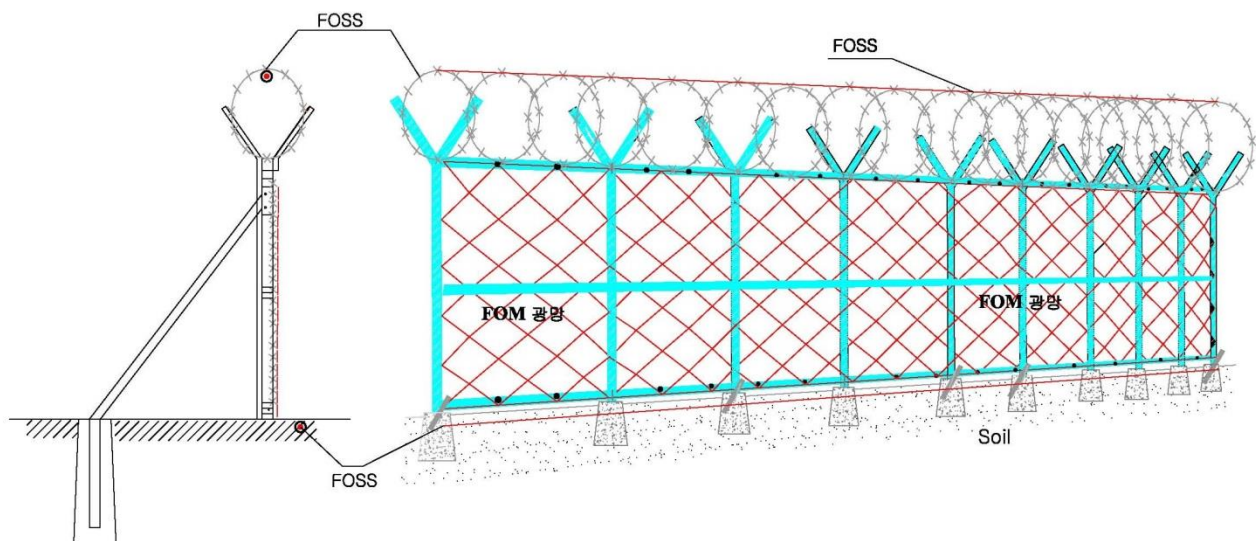
Intrusion cutting through the fence mesh shall be detected by the foolproof FOM overlaid. Intrusion climbing over the fence shall be detected by FOSS (FO Stress Sensor) mounted to the concertina top. Intruder presence in front of the fence shall be detected by buried.

Fig.3 Standing-free FOM Fence

No matter how strong how big, a metallic fence is vulnerable to intrusion cutting through or climbing over having some difference in difficulty and taking time. To protect a site surround by a metallic fence from intrusion requires additional security system no matter how strong how big the metallic fence is.

The metallic fence to be with additional security system does not have to be so strong so big costing so high but can be light and not so strong costing much lower. Standing-free FOM Fence is the right fencing solution providing fool-proof protection of the site for lower cost than conventional metallic fence with additional security system. Standing-free FOM Fence will surely be the best cost-benefit solution to put the site with no fence along the
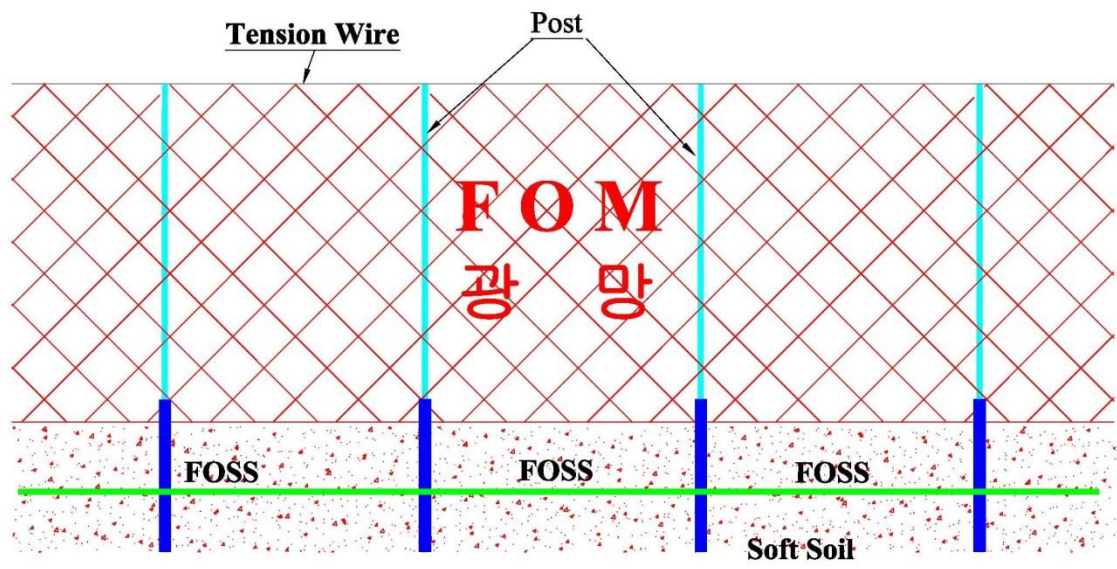
Bury FOSS (FO Stress Sensor) in front of Standing free FOM to sense intruder presence

Fig.4 Standing-free FOM Gate
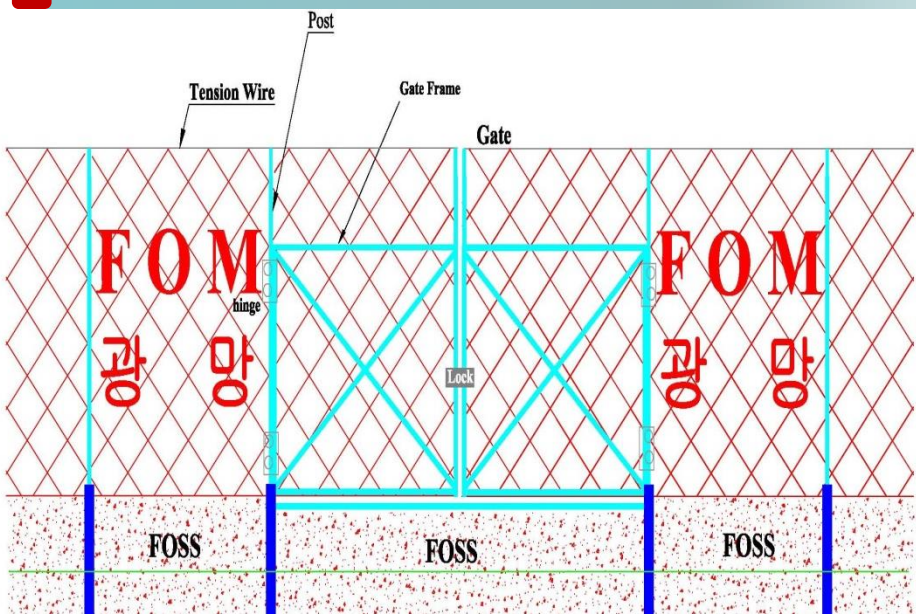
FOM Gate is made of metallic frame and FOM to be very light but capable to trigger alarm at intrusion breaking through as well gate opening.

Fig.5   FOM Fence on the Wall

Fig.6 Under water protection by FOM
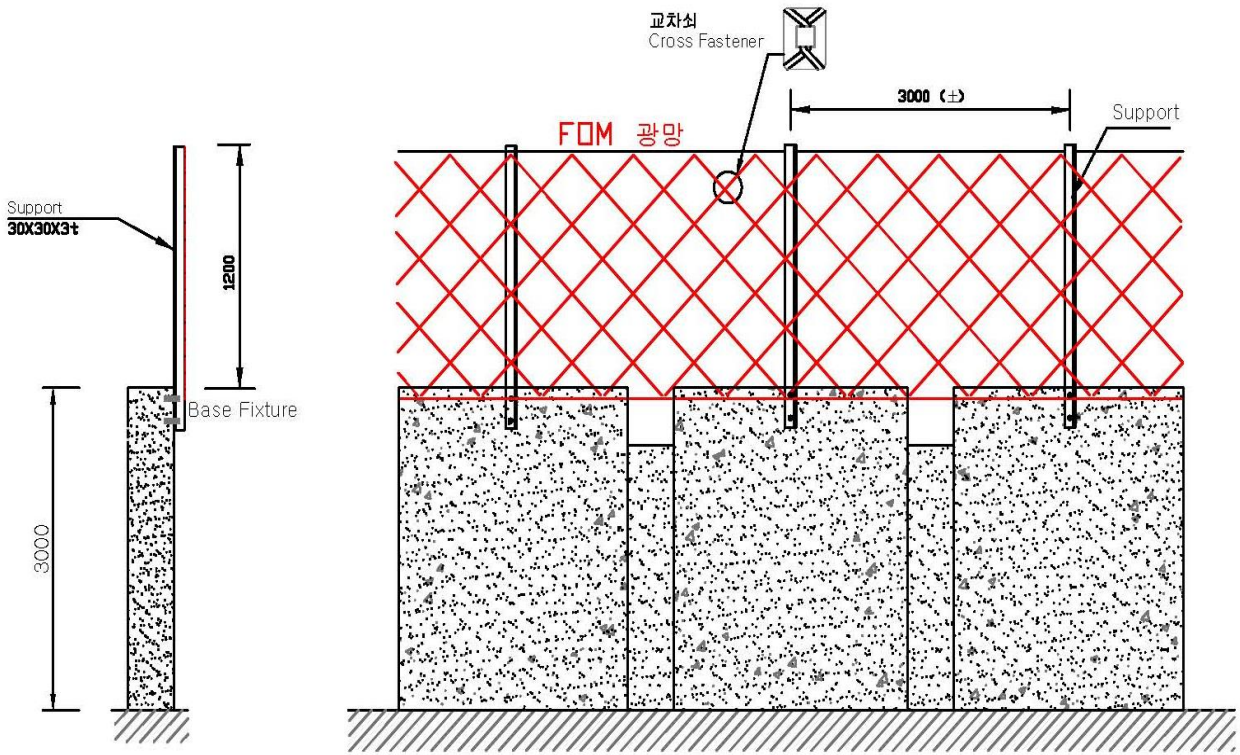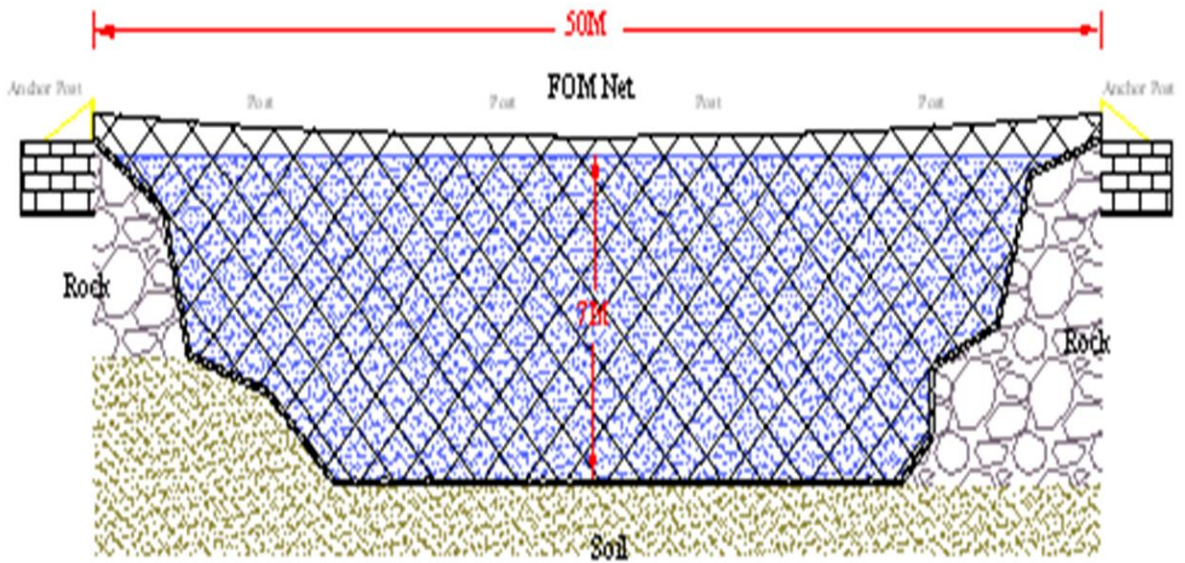
Skin & Eyes Concept Integrated Perimeter Security System

Suppose that Fence Intrusion Sensor detects and pin-points any intrusion without fail and with no nuisance alarm. Then such reliable Fence Intrusion Sensor does not need to have many Fixed Cameras while needing only a small number of PTZ Cameras.

We are to design IPSS based on skin & eye concept learned from human body for maximum cost-benefit. Human skin covers the entire surface of our body providing fool-proof protection by sensing and accurately locating an external attack.

CCTV cameras with Lamps shall provide visual evidence and assistance to guards performing duty on the sites. The cameras shall be put to watch forward or surrounding of the perimeter at usual time shall display the image of the assigned area (wall side of gate front) on the area monitor while turning on the Lamps at alarming by ACS.

But in case that intrusion happens, the nearest cameras shall immediately turn to the intrusion point to catch view and pop up it on the alarm monitor to alert the guard for attention and dispatch guard for inspection.

Our body does have only two eyes in the front but does not attach many eyes by turning the eyes to the location detected by the skin. In the proposed IPSS, we put minimum number of sensitivity cameras around the fences which are capable to catch view of long range.

FOSM shall provide 100% full proof accurate detection system with false alarm free virtually while having no alternative solution. Other forty PIDS products worldwide are reputed as ineffective and useless actually because of false alarm, weakness unable to detect intrusion, inaccuracy etc.

Fig.   Cross Section of FOM & Rotry Camera Installation at Fence
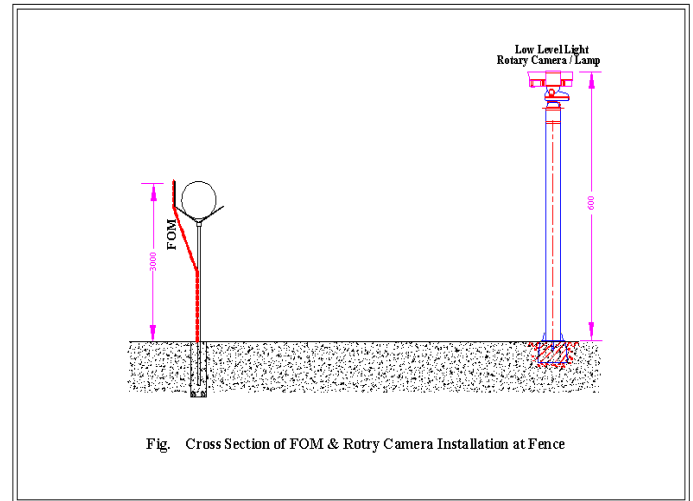
Maximum Cost-Benefits by FOM Sensor

To the first look by clients, FOM Sensor may appear as costing much higher than other fence mount cable sensors.
As to price, it is right to make Cost-Benefit analysis rather than simple direct price comparison.
All or most sites want to have Total Security Solution of Fence Intrusion Sensor interfaced with CCTV.
Other Cable Sensors are of no security effect due to severe nuisance alarm, weakness unable to detect actual intrusions, inaccurate, maintenance problem etc.
The Fence Mount Cable Sensors are usually left ignored or switched OFF soon after operation start.
The Cable Sensors are of no security effect and not worthwhile to install even for free.
The fence   is very vulnerable to intruder cutting through or to climb over in a few minutes.
The site having Total Security Solution with other Intrusion Sensor is to watch the perimeter putting many CCTV cameras turned ON over night which require illumination by Security Lightings.

FOM Sensor shall detect intruder 100% and accurately locate with out nuisance alarm to provide full proof protection like skin to human body.
Our body was created with skin and eyes to be perfectly secure from any external attacks. The best solution on how to secure the site must be learned from our body.

In Total Security Solution with FOM Sensor does not need to put many cameras, security lightings and strong fence.
The camera interfaced with FOM Sensor shall turn to intrusion spot detected by FOM to catch intruder view and pop up it on the main monitor at Security Control Room.
The number of cameras can be reduced 1/2.5 by increasing camera spacing from 200m to 500m.
Instead of separate Security Lightings, the Illuminators equipped with the Camera shall remain turned OFF at usual time but at alarming by FOM shall turn ON to the intrusion spot.
Security Lightings can be drastically reduced or removed in this way.
Because the site under FOM Solution shall neither experience nuisance alarming nor real intrusion alarming frequently and because security lightings assist intruder when and where to make intrude successfully, the site under FOM Solution shall not need many Security Lightings.
The site installed Cable Sensors just rely on CCTV Cameras and security guards like before to install the security system.
The Cable Sensors are cheap but require to put many CCTV Cameras for high cost and many Security Lighting for the highest cost. The total cost will be very big.
FOM Sensor may appear very expensive but requires to put small number of CCTV Cameras and a small number of or none of Security Lightings. The total cost will be comparable or less.

FOM Sensor Operational Performance Specifications, typical

- FOM(Fiber Optic Mesh) shall be overlaid from the fence bottom to fence top so as to surely sense intruder's cutting through and climbing over.

- FOM bottom shall be tightly fixed to each of the fence post foundation using with special fixtures (Concrete Fixture) not to be removed by hand-powered tools available by intruder and shall sense cutting or lifting up by intruder to crawl underneath FOM bottom.

- The FOM openings shall be in woven rhombic with every cross point wrapped by special fastener which does not allow intruder to open using hand-powered tools without being sensed. The rhombic FOM shall be shrinkable/stretchable to be suited to slight fence height/length variation.

- Along the soft foundation, the FOM bottom may be tightly fixed with GR(Grooved Rods) at about 30cm spacing top so as to prevent digging down to certain depth (typically 50cm) or to sense intruder's cutting or pulling up.

- The FOM can be overlaid to unattended gates so as to sense intrusion through the gate and/or the gate opening without needing additional Electro Magnetic Gate detector.

- Both ends of the 500m FOM overlaid to the fence shall be via two SFOC (Separation FO Cable) to the Main Alarm at SCC (Security Control Center).

- Both ends of the 500m FOM shall through each SFOC receive Infrared Laser pulses from the Main Alarm regularly and periodically. The Main Alarm shall be on alert continuously monitoring Optical backscatter pattern at least once per second and at intrusion identify intrusion from the presence of abnormal Optical echoes caused by cutting or pulling FOM or Taut Wires to put out alarm visibly and audibly flashing the intrusion spot within 15 meters accuracy on its own map .

- The FOM system shall be able to detect & locate within ±15m error at least two intrusions providing foolproof protection (with no gap for an intruder to penetrate without being detected) against all the three possible/designated intrusion types (cutting through, climbing over and shallow digging).

- When interfaced with Main Alarm, the CCTV Camera nearest to the intrusion spot shall automatically & accurately turn to the intrusion spot and catch and pop-up the intrusion view on the monitor at SCC.

- The OIA has provision for graphical display of the protected site. Every zone can be broken down into smaller sectors depending on the site terrain and camera covering. As the system offers a resolution of 15 meters, the exact sectoring shall be worked out on site on a case to case basis to suit ground situation. The sectoring shall be able to trigger PTZ camera to display the image taken by the CCTV camera at any alarm sector. The same alarm graphical display can be provided at other location by connecting via LAN.

- The interfacing between FOM Sensor and CCTV will be made inside SCC by having the OIA transmit Intrusion Status & Location Date either in serial data transmission to or dry contacts with CCTV Control.

- The FOM Sensor shall be free from nuisance alarm intrinsically not being affected environmental causes such as sea water, seaweed, water turbulences, rain, storm, lightening, vibration, sunshine, surge, power lines, EMI, RFI etc.

- All event data should be automatically logged in the hard disk of the OIA and also printed on paper by keyboard command. The OIA shall also communicate with Server for alarm & monitoring status reporting.

- Along the area where small animals (rat, cat etc) harm or gnaw FOM, lower portion of the FOM can be protected by Anti-gnawing Net covering.

Site Questionnaire to propose FOM Sensor and CCTV

1. Site lay-out map showing perimeter shape, length, gate, guard post, SCC (Security Control Center) etc.

2. Length and location of underground ducts between fence and SCC and of underground duct all around the wall

3. About Fence protection;
   Does there exist any fence already? If yes, provide the fence type, dimension and post interval, drawing and the photo taken close to the fence to be protected.
   In the perimeter with no existing fence, with the first priority consider Standing-free FOM for the maximum cost-effectiveness.
   To delay intrusion by enough time for the security guards to reach the intrusion spot, put additional concertina rolls inside the FOM

 c) What is the fence foundation among Concrete, Rock, Soil, Sand ? Does the fence require to detect digging underneath the fence?

About Gate protection:
 Our Fence Intrusion Sensor can detect both intrusion through the gates and gate opening without out needing additional Electronic Processor in addition to the intrusion through the fence.
 Does there exist any gates to be protected already? If yes, provide the gate type, dimension and post interval, drawing and the photo taken close to the gates to be protected. Specify what type of detection (among intrusion through gate and gate opening) to be detected.

5. If exists underground duct between fence and SCC, then what is the length of the duct?

6. Distance between Security Control Center and the fence to be protected

7. The working conditions along the perimeter such as road or geometry.

8. Does the site want to install CCTV Cameras interfaced intrusion sensor?

9. Does the site installed security lightings around the fence already. If not, be advised not to install security lightings but to put CCTV Cameras with Illuminators?

10. Give description of underground SM (Single Mode) Fibers ? LAN? Internet? Existing communication network?

11. Are Electrical Power drops available along the fence?

12. Any RFP specifications available ? Any special customer requirements regarding the operational performances?

13. Name of site and location

14. Expected date of contract:

15. Expected date of operation start: