

Anti UAV Protection System

Ground SPARK System (GSS)

Unclassified Presentation

May 2015



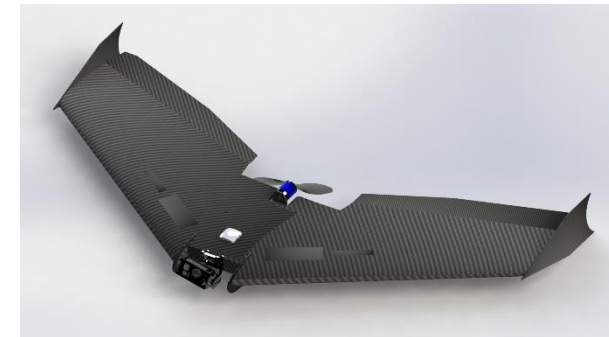
ARIEL Photonics Assembly Ltd
Proprietary unclassified



Content

- The Needs
- GSS: Ground Spark System Laser based solution
- Concept of Active Protection System –”Onion Layers”
 - Detection layer – interface to RADAR or Electro-Optic detector
 - “Soft Kill” layer – RF Jammers, Laser Jammers
 - “Hard Kill” layer – Mil-Spec High Power Fiber Laser
- Maturity of the system
- Safety related issues
- Summary

The Needs: Protection against Mini/Micro UAV



Examples of UAVs and altitude level



The layers
we are
handling with
the system

Mini and
Micro UAVs

System Description

GSS Anti-UAV system is designed to detect, verify, disrupt and neutralize hostile Unmanned Aerial Vehicles (UAVs).

It includes a Detection System and a Protection System



Protection system

Day/Night verification of potential treats,
video tracking and gimbal pointing,
laser video jamming, laser burning,
operation, monitoring and control of protection system,
video and data backlog of events

Directional and Omnidirectional RF Jamming and Immobilization

Detector system, via interface

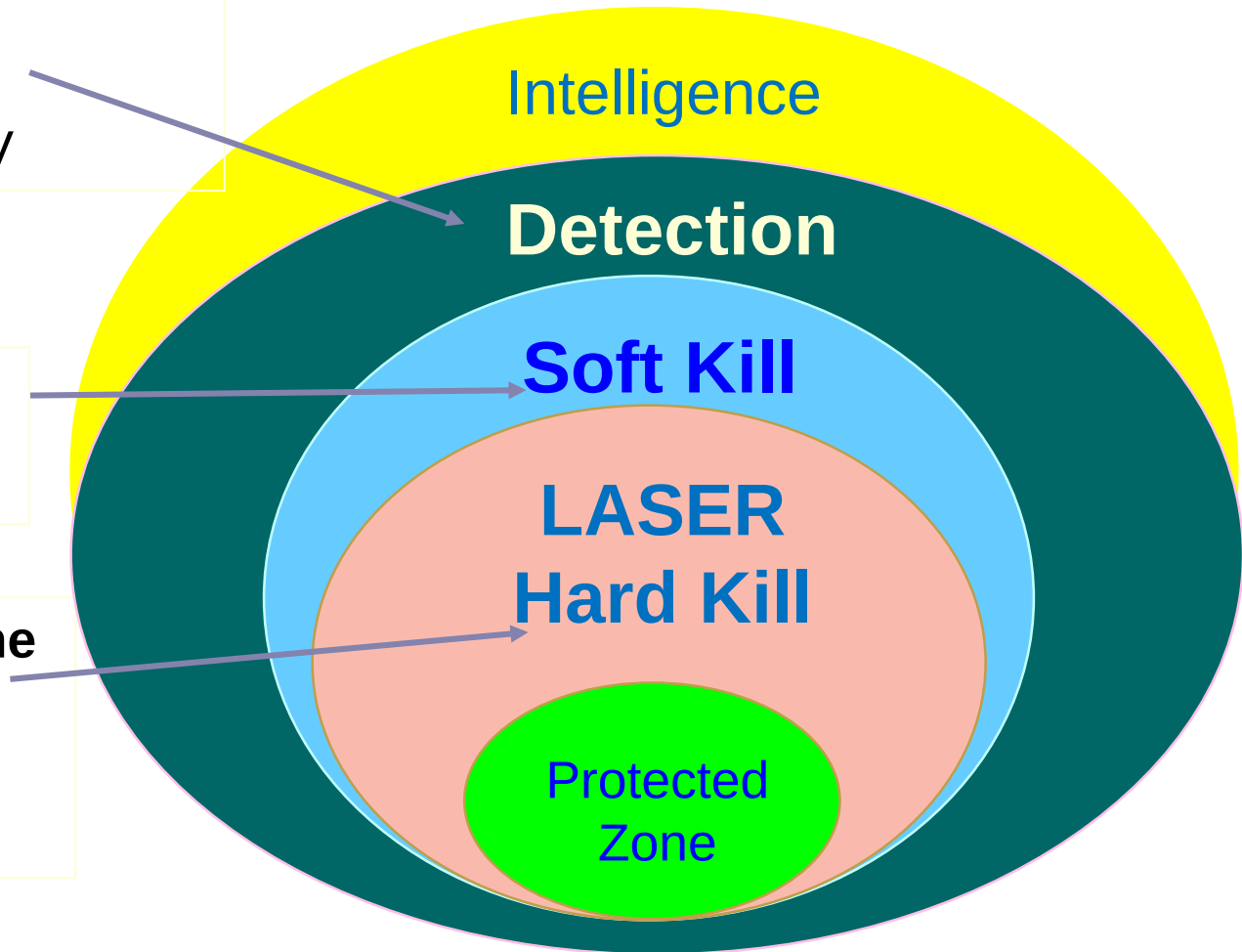
Panoramic (360deg) Radar or Electro-optic Detection and Classification
of mini UAVs and Quadcopters, monitoring and control of threats

Multilayer Survivability Protection against Mini/Micro UAVs

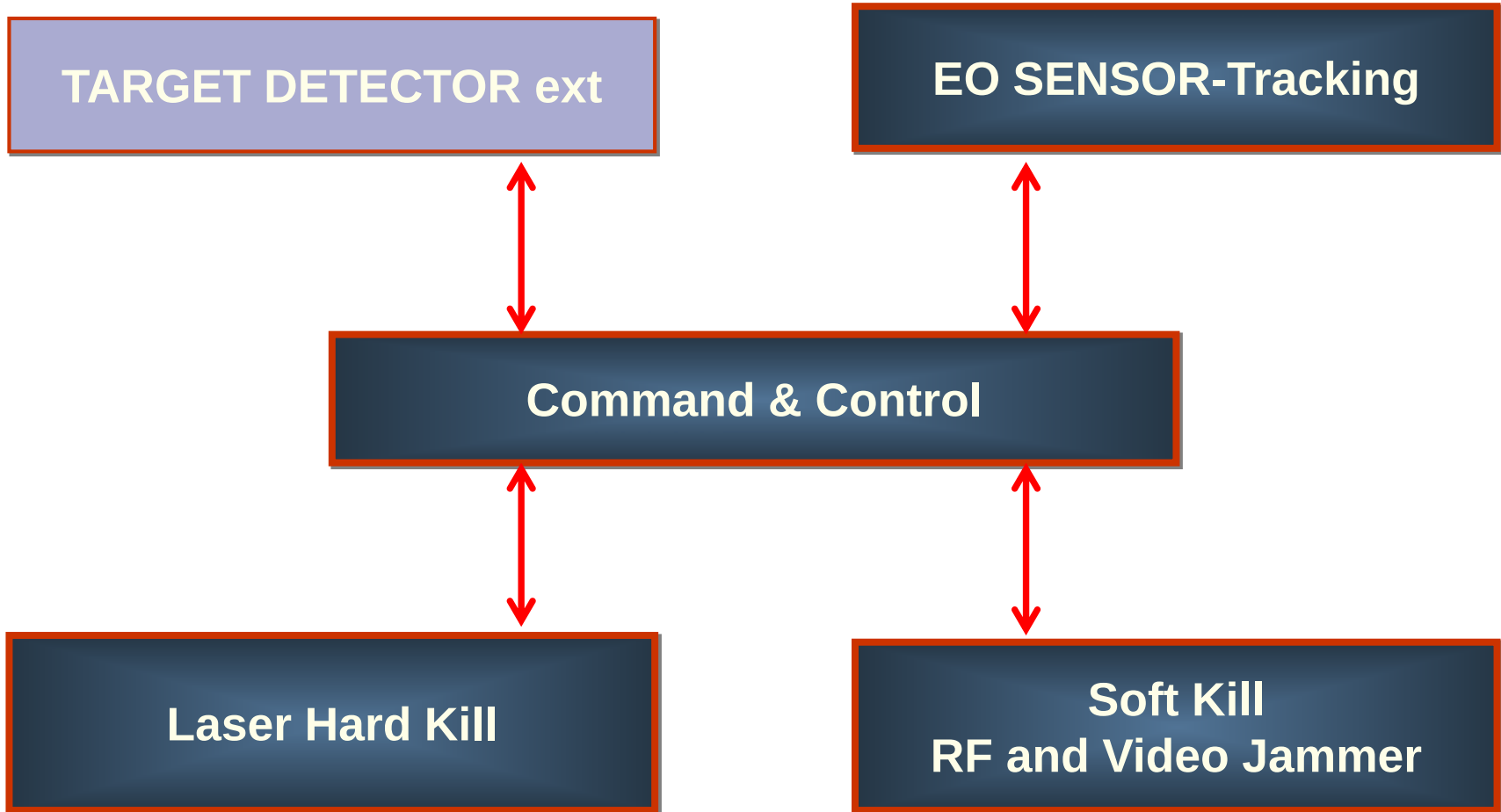
Threat Location
for Mini UAV
for Micro UAV

Jamming
At shorter range

Threat Killing Zone
for Mini UAV
for Micro UAV



Active Protection System Architecture



Building Blocks of GSS



Mobile compact system against Micro/mini UAVs

- Target Detector: Wide angle detection
- RF Omni and Directional: Jamming systems block RF communications frequencies and GPS
- EO Tracker unit: Gimbal+ Narrow optical sensor + telescope (Beam director) + Directional RF Antenna
- Control unit: Electronics module + Joystick (a men in the loop decision if needed)
- HPFL: Directed Mobile High power Fiber Laser KW CW SM

Active protection system against UAVs

Gimbal, optical sight, telescope, men in the loop



Option of EO Tracker,
RF Jammer
Video Camera Jammer



Option of EO Tracker,
Video Camera Jammer
High power fiber laser
CW SM KW

Target Detector Mission: Tactical Air Surveillance

- Detection of all Types of Aerial Objects: Fighters, Helicopters, UAVs, Transport Aircraft, Ultra-Light Aircraft, and others
- Target Classification/Identification
- Hemispheric Detection Volume
- Azimuth Coverage of up to 360° (Increments of 90°)
- Stationary or Mobile/On-the-Move Application
- Simultaneous Management of Numerous Tracks
- Integrability with existing C4I Systems, Sensors and Weapon Systems
- Extended Capabilities:
 - Operator-Control or Remote-Control of Operation Modes
 - Perimeter Surveillance Mission (Vehicles, Pedestrians)

Detector Field Performance

- Tactical UAVs:
 - Raven & Bird ($0.2 \times 2 \text{ m}^2$)
 - Quadcopter ($0.4 \times 0.4 \text{ m}^2$)





Electro-optical Day / Night verification and tracking for Laser Kill Anti-UAV Defense

Coverage 360°
Target Detection
Jamming GPS & Control
Jamming Video camera
Laser Kill



Day



Night

Status: Tracking(C)

Range: 905

R:10 14/05 12:04:41 EL:-13.10 AZ:+168.13 FOV:02.1MILR

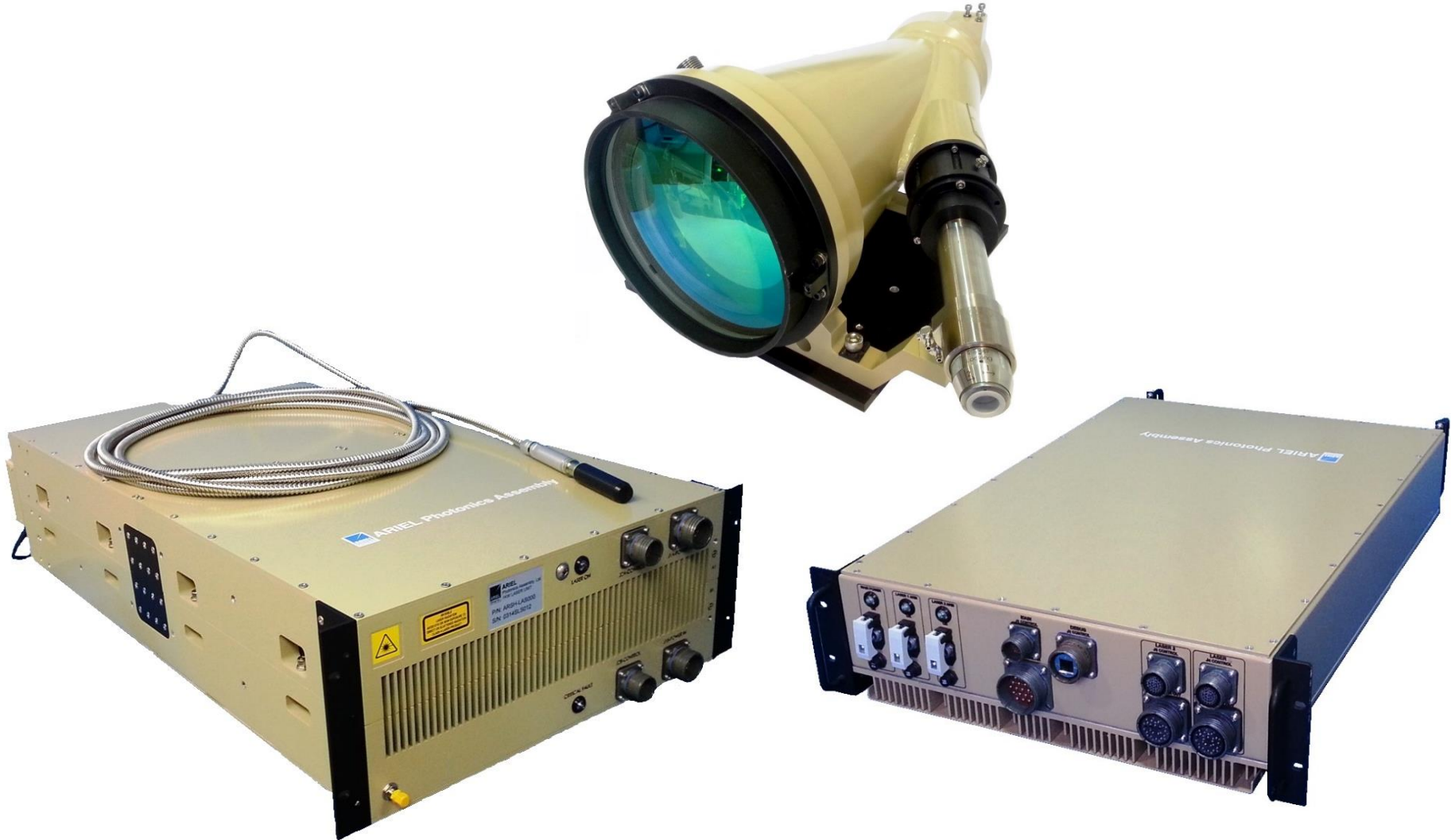
RF Jammer

RF Omni and Directional jamming systems block RF communications frequencies and GPS

- Blocks all bands transmit simultaneously
- Operation from a distance remote control computer
- Separate communication for each Jammer
- Each jammer has its own controllers that communicate with the server computer
- Wide frequency coverage (60-6000 MHz)
- Unique digital adaptive, pure and precise spectrum
- No interference to nearby frequency bands
- Various modulation types jamming capability
- Operational Power: 90-260 VAC



ARIEL's Mil Spec SPARK 1kW Fiber Laser and Beam Director



Sequence of operation

1. External Target detector detects an UAV, calculates coordinates, provides classifications and issues warnings. Detector system allows to operator to evaluate the situation and to override priorities
2. External Target detector system transfers target coordinates and classifications to command and control unit of protection system.
3. Gimbal, EO cameras, RF jammer and laser are directed towards the target. EO camera reacquires the target, and locks on it. Cameras make precise focusing and tracking of UAV. Control unit records video and details of the event
4. Upon operator permission, RF and Optical jammers block communication, GPS and video channels of the UAV, immobilizing and deflecting most of UAVs
5. Control unit reevaluates classification of targets and returns new status of targets to the External Target detector system
6. Laser burns out UAVs when they match certain predefined criteria (too close, too fast, wrong location etc.)
7. All event video and log are recorded in the control unit memory



Maturity and Safety

1. The protection system is build from modules that are in production for few years.
2. The system passed outdoor live demonstration, successfully detecting, tracking and deflecting micro UAVs at the working ranges
3. The system does not produce any RF electromagnetic danger.
4. The system produce laser danger. Laser beams shall be screened out to block public from direct observation of laser beams
5. Laser kill shall be conducted in predefined zones, that insure no danger from laser scattered light (reflected by / from UAVs)



Summary

- Unique concept of full systems solution.
- “Soft Kill” RF Jammer and ”Hard Kill” Laser integrated to external Target detector (RADAR or E/O) as a first trigger
- Final targeting including a precise Gimbal, narrow Optical cameras (day+ night+ illumination) and compact telescope (for the HPFL beam).
- Control unit provides for “men in the loop”
- The entire system main features:
 - Low cost
 - High efficiency
 - Mobility
 - Easy operation



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