BIS Category XII Notice of Inquiry
(82 FR 4287, published January 13, 2017)
Public Comments

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Akin Gump
STRAUSS HAUER & FELD LLP

March 14, 2017

VIA DDTCPUBLICCOMMENTS@STATE.GOV AND WWW.REGULATIONS.GOV

Mr. C. Edward Peartree
Office of Defense Trade Controls Policy
U.S. Department of State
Directorate of Defense Trade Controls
PM/DDTC, SA-1, 12th Floor
Washington, DC 20037

Dr. Christopher Costanzo
U.S. Department of Commerce
Bureau of Industry and Security
1401 Constitution Ave. NW
Washington, DC 20230

Re: Notices of Inquiry – Request for Comments Regarding U.S. Munitions List Category XII (DOS-2017-0002) and Request for Comments on Increase of Controls for Infrared Detection Items (RIN 0694-XC035)

Dear Mr. Peartree and Dr. Costanzo:

We represent various organizations based in the United States that conduct activities related to infrared detection items subject to the Export Administration Regulations (EAR). On January 13, 2017, the Department of State's Directorate of Defense Trade Controls (DDTC) and the Department of Commerce's Bureau of Industry and Security (BIS) published notices of inquiry (NOIs) that would greatly affect our clients. As a result, we hereby submit public comments to both agencies on behalf of our clients.

COMMENTS ON THE DDTC NOI

The NOI (82 FR 4226) published by DDTC focused on three main issues: (1) alternatives to current controls using "specially designed for a military end user," (2) comments on Category XII(b)(1), and (3) comments on proposed technical parameters to replace "specially designed" in current entries in Category XII. These public comments focus on the first and third issues. For each proposal reviewed, our clients have prepared findings and recommendations, as described more fully below.

Comments on "Specially Designed for a Military End User" Parameter

Current USML Category XII(b)(6): Light detection and ranging (LIDAR), laser detection and ranging (LADAR), or range-gated systems, specially designed for a military end user

- Findings: Our clients were unable to identify technical or other objective parameters or parameters-based definitions that would create a "bright line" to clearly distinguish between civil commercial systems and military systems. Resorting to utilizing specific performance-based parameters to create such a distinction will result in constraining commercial development and utilizing foreign vendors, which will enhance the competitive advantage of such foreign vendors. Several civil commercial products made by companies such as Neptec, Luminar, and Velodyne are likely to be captured by this control without the requisite distinction.

- Recommendation: Keep the current text in Category XII(b)(6), *i.e.*, with the "specially designed for a military end user" language to ensure that strictly commercial development can proceed without being affected by the scope of Category XII.

Current USML Category XII(c)(1)(iii): Binoculars, bioculars, monoculars, goggles, or head or helmet-mounted imaging systems (including video-based articles having a separate near-to-eye display), as follows: having an infrared focal plane array or infrared imaging camera, and specially designed for a military end user.

- Findings: Our clients were unable to identify new technical or other objective parameters that would create a bright line to clearly distinguish between civil commercial commodities and military commodities.

- Recommendations:

  (i) Remove XII(c)(1)(iii) because the current controls in XII(c)(1)(i) and (ii) are sufficient to address the policy objectives of the control in XII(c)(1).

  (ii) As an alternative, keep XII(c)(1) as is, but include the use of "specially designed for a military end user" in XII(c)(1)(iii).

Current USML Category XII(c)(3): Electro-optical reconnaissance, surveillance, target detection, or target acquisition systems, specially designed for articles in this subchapter or specially designed for a military end user.

- Findings: Our clients were unable to identify technical or other objective parameters that would create a bright line to clearly distinguish between civil commercial commodities and military commodities. Also, our clients are concerned that if "specially designed…" is removed, then interpretation of the word "target" could capture civil and commercial products, and interpretation of the words "reconnaissance," "surveillance," and "acquisition" could also capture civil and commercial products.

- Recommendations:

  (i) Add definitions for "reconnaissance," "surveillance," and "acquisition" that are specific to a military end user.

  (ii) In addition, use the definition of "target" in the Note to paragraph XII(c)(6)(i) to limit the scope of that term in XII(c)(3) and keep the current text using "specially designed for a military end user."

Current USML XII(c)(4)(ii): Infrared search and track (IRST) systems having one of the following: Specially designed for a military end user.

- Findings: Our clients were unable to identify technical or other objective parameters that would create a bright line to clearly distinguish between civil commercial commodities and military commodities. Further, our clients are concerned that an ordinary, common interpretation of "infrared search and track" could capture civil commercial items if "specially designed…" is not retained.

- Recommendations:

  (i) Define "infrared search and track" systems specific to military applications in XII(c)(4)(i) and remove the control in XII(c)(4)(ii) because (c)(4)(i) already sufficiently addresses the policy objectives of the control.

  (ii) As an alternative, keep the current text in XII(c)(4) using "specially designed for a military end user" in XII(c)(4)(ii).

Current USML XII(c)(5): Distributed aperture systems having a peak response wavelength exceeding 710 nm specially designed for articles in this subchapter or specially designed for a military end user.

- Findings: Our clients were unable to identify technical or other objective parameters that would create a bright line to clearly distinguish between civil commercial commodities and military commodities. Also, if "specially designed…" is not retained, then our clients are concerned that ordinary commercial application of the term "distributed aperture" would capture civil and commercial items.

- Recommendation: Keep the current language as is, *i.e.*, "specially designed for a military end user."

Current USML XII(c)(6)(viii)(B): Infrared imaging systems, as follows: gimbaled infrared systems, as follows: specially designed for articles in this subchapter or specially designed for a military end user.

- Findings: Our clients were unable to identify technical or other objective parameters that would create a bright line to clearly distinguish between civil commercial systems and military systems.

- Recommendation: Keep current XII(c)(6)(viii)(B) language intact, *i.e.*, with "specially designed for a military end user."

Current XII(c)(7)(ii): Terahertz imaging systems as follows: specially designed for a military end user.

- Findings: Our clients believe current XII(c)(7)(i) already provides a sufficiently clear bright line between military and commercial systems.

- Recommendations:

  (i) Remove XII(c)(7)(ii) because (c)(7)(i) already addresses the policy objectives of the control.

(ii) As an alternative, keep the current XII(c)(7) language intact, including the use of "specially designed for a military end user" in (c)(7)(ii).

Comments to Assist with the Evaluation of Potential New Control Parameters

A. Free-space laser communication systems specially designed for articles in this subchapter.

- Findings: The proposal would capture civil commercial applications if "specially designed for articles in this subchapter" is removed. Civil commercial free-space laser communication systems are currently under development and are expected to enter the market in the next few years. Several U.S. and foreign companies such as Airbus Defense and Space, TESAT Spaceport GmbH, RUAG, iXBLUE Photonics, Gooch and Housego Systems, NEC, Mitsubisi, Deutsche Zentrum fur Luft-und Raumfahrt, Sony, and ViaLight Communications are likely active in developing civil commercial products that are free-space laser communication systems. Additionally, Lightpointe (http://www.lightpointe.com) and Fsona (http://fsonadirect.com) sell civil commercial free-space laser communications systems today.

- Recommendations:

  (i) If this proposal is adopted, keep "specially designed for articles in this subchapter;" or

  (ii) If specific control parameters are used without "specially designed," then this additional control should not be added to the ITAR.

B. Binoculars, bioculars, monoculars, goggles, or head or helmet-mounted imaging systems (including video-based articles having a separate near-to-eye display), having any of the following: (i) A dynamically gain modulated image intensifier tube incorporating a GaAs, GaInAs, or other III–V semiconductor photocathode with a peak response in the wavelength range exceeding 400 nm but not exceeding 2,000 nm; (ii) An image intensifier tube incorporating a photocathode with a peak response in the wavelength range exceeding 400 nm but not exceeding 2,000 nm and incorporating a focal plane array in the tube vacuum space; (iii) Fusing outputs of multiple infrared focal plane arrays each having a peak response at a wavelength greater than 1,000 nm; (iv) An infrared focal plane array with a peak response in the wavelength range exceeding 1,000 nm but not exceeding 2,500 nm with a total noise floor less

than 75 electrons at an operating temperature of 300 K; or (v) An infrared focal plane array with a peak response in the wavelength range exceeding 7,500 nm, and a laser illuminator or pointer.

- Findings: Our clients believe that civil commercial items and end use are expected for items that meet or exceed the control criteria in (iii), (iv), and (v).

- Recommendations:

  (i) Revise the proposal by removing (iii), (iv), and (v); or

  (ii) Maintain the current text in Category XII(c)(1), which would continue to include "specially designed for a military end user" as a control parameter.

D. Infrared imaging systems, as follows: Mobile reconnaissance, mobile scout, or mobile surveillance systems, that provide real-time target geolocation at ranges greater than 3 km (e.g., LRAS3, CIV, HTI, SeeSpot, MMS).

- Findings: It is unclear why the current Note to this entry (XII(c)(6)(i)) was omitted. Without that note, the interpretation of the word "target" could reasonably be interpreted to include civil commercial products exceeding the range of 3 km. Civil commercial items that meet or exceed the 3 km range either exist today or are being developed for civil commercial applications. Also, a reasonable interpretation of "reconnaissance," "surveillance," and "acquisition" would capture civil commercial products.

- Recommendations:

  (i) Add definitions for "reconnaissance", "surveillance" and "acquisition" that are specific to military end use, and maintain the definition of "target" and make applicable to all entries in Category XII that use that term.

  (ii) If "target" is not defined, then the range specification of 3 km should be raised so that this entry does not capture civil commercial systems.

E. Infrared imaging systems, as follows: Gimbaled infrared systems (e.g., T-bar, yoke, ball turrets, or pods), as follows and specially designed parts and components therefor: (i) Having a root mean square (RMS) stabilization better (less) than 25 microradians and incorporating an infrared camera having a peak response at a wavelength exceeding 1,000 nm with an optical angular resolution (i.e., detector instantaneous field-of-view) of 25 microradians or less; (ii) Having an RMS stabilization better (less) than 25 microradians for any payload having any dimension of 15 inches or greater; or (iii) Specially designed for articles in this subchapter or specially designed for a military end user.

- Findings: Civil commercial items that meet or exceed the control criteria in (i) exist today, and civil commercial items that meet or exceed the criteria in (ii) are either currently produced or under development for use in the next few years.

- Recommendations: Adopt all of the following:

  (i) Reject the proposed control due to concerns with (i) and (ii).

  (ii) Remove the current control in XII(c)(6)(viii)(A). It is likely that the stabilization requirement of better (less) than 30 microradians RMS will capture commercial items in the next few years. Additionally, the ball diameter specification of 15 inches appears to be unrelated to the performance of gimbaled infrared systems and provides an arbitrary size limit that U.S. companies would be forced to avoid in the commercial market.

  (iii) Maintain the current control in XII(c)(6)(viii)(B), which uses "specially designed for a military end user."

I. Infrared focal plane arrays or dewars specially designed for optical augmentation reduction.

- Findings: A reasonable interpretation of "optical augmentation reduction" would capture civil commercial applications.

- Recommendation: Do not adopt this control and keep the current text in Category XII(e)(5) and (e)(15).

L. Infrared focal plane arrays having greater than 81,920 but not exceeding 327,680 detector elements, a peak response in the wavelength range 1,100 nm but not exceeding 1,700 nm, and any of the following: (i) Noise equivalent irradiance less than 829 million photons per centimeter squared per second; (ii) Readout integrated circuits capable of pulse interval modulation decoding or pulse repetition frequency decoding (e.g., an asynchronous detector read out integrated circuit, frame rates windowed or non-windowed greater than 2,000 Hz); or (iii) Temperature dependent non-uniformity correction (e.g., without the use of a temperature stabilization).

- Findings: Civil commercial items that meet or exceed the control in (i) exist today or are under development for sale in the next few years by FLIR and foreign companies such as Xenics (Belgium). The control in (iii) is ambiguous and can capture simple temperature sensitive calibrations. All items described by this proposal that are not specially designed for a defense article are already controlled under ECCN 6A002 in the EAR and have strict licensing requirements.

- Recommendation: Do not adopt this control and keep the current text in Category XII(e)(5).

M. Infrared focal plane arrays having greater than 327,680 detector elements, a peak response in the wavelength range exceeding 1,100 nm but not exceeding 1,700 nm, and any of the following: (i) Noise equivalent irradiance less than 1.54 billion photons per centimeter squared per second; (ii) A readout integrated circuits capable of pulse interval modulation decoding or pulse repetition frequency decoding (e.g., an asynchronous detector read out integrated circuit, frame rates windowed or non-windowed greater than 2,000 Hz); or (iii) Temperature dependent non-uniformity correction (e.g., without the use of temperature stabilization).

- Findings: Civil commercial items that meet or exceed the control in (i) exist today or are likely under development for sale in the next few years by IR Cameras and foreign companies such as Xenics (Belgium), Photonic Science (UK), and Raptor Photonics (Ireland). The control in (iii) is ambiguous and would reasonably be interpreted by civil commercial users as capturing simple temperature sensitive calibrations. All items described by this proposal that are not specially designed for a defense article are already controlled under ECCN 6A002 in the EAR and have strict licensing requirements.

- Recommendation: Do not adopt this control and keep the current text in Category XII(e)(5).

R. Microbolometer focal plane arrays having an unfiltered response in the wavelength range exceeding 7,500 nm but not exceeding 14,000 nm and any of the following: (i) Vacuum packaged and specially designed to withstand weapon shock; or (ii) Greater than 328,000 detector elements with a detector pitch less than or equal to 14 microns.

- Findings: Civil commercial items that meet or exceed the control in (ii) exist today. Additionally, civil commercial items that meet or exceed the criteria are either currently produced or likely under development for sale in the next few years by foreign companies such as ULIS (France) and INO (Japan). Further, the control in (i) is problematic since many civil commercial items incorporating a focal plane array are required to meet a commercial shock standard in case the item is dropped. It is possible that commercial shock requirements could approach or exceed a weapon shock standard, which raises concerns on how "specially designed to withstand weapon shock" would be interpreted by DDTC. Lastly, all items described by this proposal that are not specially designed for a defense article are already controlled under ECCN 6A002 in the EAR and have strict licensing requirements.

- Recommendation: Do not adopt this control and keep the current text in Category XII(e)(5).

U. Analog readout integrated circuits specially designed for articles in this subchapter.

- Findings: This proposal would capture civil commercial applications if "specially designed for articles in this subchapter" is removed. Also, without the modifier of "infrared" as currently used in Category XII(e)(14), this proposal would likely capture 600 series ROICs.

- Recommendation: Due to concerns with Proposal V (see below), keep current Category XII(e)(14) text for all ROICs with "infrared focal plane array ROICs specially designed for articles in this subchapter."

V. Digital readout integrated circuits specially designed for focal plane arrays having a peak spectral response in the wavelength band exceeding 1,100 nm but not exceeding 30,000 nm, a digital signal output, and any of the following: (i) Dynamic range greater than 54 dB; or (ii) Pixel read-out rate greater than 540 million bits per second.

- Findings: This proposal would capture civil commercial applications. ECCN 6A990 already controls such items.

- Recommendation: Do not adopt this control and keep the current text in Category XII(e)(14) for "infrared focal plane array ROICs specially designed for articles in this subchapter."

COMMENTS ON THE BIS NOI

Our clients wish to comment on three of the potential revisions to increase controls for infrared detection items subject to the EAR – (1) removing License Exception STA eligibility for certain 6A003 cameras to be embedded in higher level assemblies; (2) adding additional license requirements for certain materials and related technology in ECCNs 3C001 and 3E001, respectively; and (3) imposing a license requirement for Canada for certain technology in ECCNs 6E001, 6E002, and 6E990.

Comments on Removing License Exception STA Eligibility

Currently, 6A003 cameras may be authorized under License Exception STA for destinations in Country Group A:5. This has been the case since the license exception was created in 2011. Our clients are concerned with the potential revision to restrict the use of License Exception STA for infrared imaging cameras in 6A003.b.4 that are being exported to be embedded into a higher level assembly and that incorporate two dimensional FPAs specified in 6A002.a.3.c or a.3.f having more than 328,000 detector elements. This proposed revision seems unnecessary for the type of transactions affected, appears to disregard the extensive foreign availability for the 6A003 cameras described in this proposal, and furthers a competitive disadvantage for U.S. companies.

Under this proposal, STA would no longer be available for exports or reexports of 6A003 cameras meeting the description above to be embedded by commercial users into a commercial system in allied countries in Country Group A:5. This is because § 744.9 currently requires a license for the export, reexport, or transfer (in-country) of 6A003 cameras for use by military end users or for incorporation into foreign military commodities. It seems unnecessary to now

require a license for lower risk transactions (involving commercial users and applications) in lower risk countries (Country Group A:5).

This potential revision also seems unnecessary in light of the strict requirements of the license exception. STA includes a number of requirements that exceed those of other license exceptions, including completion of a Prior Consignee Statement, providing ECCN(s), and sending notifications of shipments. There is an extensive audit trail for the U.S. Government through recordkeeping requirements and also through mandatory filings in the Automated Export System. Consignees are even required to agree to permit an end-use check by the U.S. Government. Such compliance responsibilities and obligations are similar to (and may even exceed) those for licenses, and should provide the U.S. Government with assurances that STA is and remains an effective authorization for 6A003 cameras to be embedded into higher level assemblies.

BIS's potential revision also seems to disregard the foreign availability of 6A003 cameras. Public commenters have previously supplied extensive data on foreign availability in response to both the first and second proposed rules related to USML Category XII. This foreign availability exists in countries in Country Group A:5, but it also exists in non-A:5 countries, including China. A foreign integrator could easily source non-U.S. camera cores, and the foreign supplier could likely send such cores without needing to obtain a license, due to the "NS2" level of control maintained by the Wassenaar Arrangement for 6A003. Because of this multilateral control, which is already less stringent than the U.S. unilateral "RS1" control, U.S. companies face a competitive disadvantage compared to their foreign competitors, and the removal of STA in this proposal will only make the disadvantage worse.

Because this NOI brings up the issue of STA eligibility, our clients respectfully request that BIS also consider whether the removal of STA is warranted, in the context of deemed exports, for 6E001 and 6E002 technology related to items in 6A002 and 6A003, as well as for 6E990 technology. Due to the reduced flexibility in authorizing third-country nationals in the United States compared to third-country nationals outside of the United States, the use of STA would be particularly helpful to reduce the anticipated burden associated with applying for individual deemed export licenses for foreign persons in the United States. Under STA, the company releasing the technology to the foreign person would be required to provide notification to the foreign person, perhaps in the form of a non-disclosure agreement, that informs the individual of the restrictions in releasing the technology or source code at issue, and that imposes limits that are equivalent to or more restrictive than those limits set by the EAR. As with any other authorization under STA, BIS would be able to conduct audits to ensure compliance with the EAR. We believe these protections should make it permissible to allow STA to authorize deemed exports in the United States for nationals of Country Group A:5.

Comments on Additional License Requirements for ECCNs 3C001 and 3E001

Our clients are concerned about potential ambiguity and inconsistency with multilateral controls by proposing to add an "RS1" control for certain materials in 3C001 and related technology in 3E001.

The proposal would add an "RS1" control for items in 3C001 that are III-V compounds of gallium or indium, and aluminum, antimony, or arsenic, forming a strained layer superlattice having a photoluminescence signal maxima originating from the superlattice in the wavelength range exceeding 3,000 nm but not exceeding 15,000 nm at a temperature less than 200 K. It is unclear, however, whether the specific materials described in this proposal are all currently controlled under 3C001. We respectfully request that BIS confirm whether this proposal is only intended to apply to a subset of materials currently controlled in 3C001.d, or whether this proposal actually exceeds the scope of 3C001 (and consequently, related technology in 3E001).

If this proposal is intended to be done within the context of the multilateral controls in 3C001 and 3E001, then we also recommend that pursuing a change to the level of control in conjunction with fellow members of the Wassenaar Arrangement would be preferable to pursuing a unilateral control, which would likely put U.S. companies at a competitive disadvantage.

Adding a License Requirement for Canada for Certain Technology in ECCNs 6E001, 6E002, and 6E990

Our clients are also concerned with the proposal to impose a new license requirement for certain technology controlled in ECCNs 6E001, 6E002, and 6E990 for Canada. This would impose new burdens in collaborating with Canadian facilities and utilizing Canadian employees inside the United States. In addition, this would impose a license requirement to release technology that has already likely been released as NLR. Further, other countries possessing this technological capability do not impose a license to export such technology to Canada. Therefore, it is unclear what policy objectives this proposal would achieve.

We believe that adopting this proposal would harm the U.S.-Canada defense and economic relationships without furthering U.S. national security and foreign policy goals. Thus, we respectfully request that BIS proceed as it did after proposing similar license requirements in the first Category XII proposed rule by not adopting such a license requirement.

CONCLUSION

Our clients thank you for the opportunity to comment on the proposals put forward in the NOIs published by DDTC and BIS. If you have any questions regarding these comments or require additional information in reviewing the proposals, please feel free to contact me via email at semme@akingump.com or via telephone at 202-887-4368.

Sincerely,

Steven C. Emme

PUBLIC SUBMISSION

As of: 3/21/17 9:20 AM
Received: February 27, 2017
Status: Pending_Post
Tracking No. 1k1-8uz6-bzgy
Comments Due: March 14, 2017
Submission Type: Web

Docket: BIS-2017-0001
Increase of Controls: Infrared Detection Items

Comment On: BIS-2017-0001-0001
82 FR 4287 Cat XII BIS NOI 1-13-17

Document: BIS-2017-0001-DRAFT-0003
Comment on FR Doc # N/A

Submitter Information

Name: Anonymous Anonymous

General Comment

Team Department of Commence,

I would like to comment on proposed changes to the Category XII of the United States Munitions List (USML) and proposed changes to the Commerce Control List (CCL) Category VI. Thank you for the valued suggestions. After evaluation of the proposed changes among my peers, we agree with the proposed changes.

We appreciate the steps you are taking to improve and enhance Category XII of the United States Munitions List (USML) and proposed changes to the Commerce Control List (CCL) Category VI.

Best regards,

CLEAR ALIGN
electro-optic systems & subsystems

Regulatory Policy Division
Bureau of Industry and Security
U.S. Department of Commerce
14th Street and Pennsylvania Ave., N.W.
Room 2099B
Washington, D.C. 20230

Subject: BIS Notice of Inquiry, RIN 0694-XC035

To Whom It May Concern:

Thank you for this opportunity to comment regarding potential changes to the recently finalized Category VI of the Commerce Control List.

General Comments:

As a company, we would like to see the regulations for Category VI of the CCL remain as written, and wait for further evaluation of potential changes after the current regulations have been in place for 18 months to two years.

Once again, this NOI seeks to put back in place additional license requirements and remove licenses exceptions, similar to the first proposed rule for this category of controls. We feel that over control at any level does not benefit the US economy, our academic institutions or national security. Wide foreign availability of technology, many listed in this NOI, means that strict controls are not warranted, especially the suggested addition of a license requirement for Canada.

Specific Comments:

In particular in the announcement, the following was written:

> Potential Revision.
>
> Remove STA eligibility for infrared imaging cameras controlled in ECCN 6A003.b.4 that: (i) Are being exported to be embedded into a higher level assembly, system or equipment; and (ii) incorporate two dimensional FPAs specified in either ECCN 6A002.a.3.c or ECCN 6A002.a.3.f, and that have more than 328,000 detector elements.
>
> Rationale. Removing STA eligibility for such items will ensure that those infrared imaging cameras to be embedded (e.g., kits, cores, modules) that

could exceed the size of those incorporated in military fielded systems, receive U.S. Government review when exported for incorporation into commercial/civil equipment and systems.

Clear Align Comments:

Our company is currently using STA for a shipment of items that are categorized under ECCN 6A003.b.4.a into the European Union. This contract is of significant value and is also a pre-cursor to even larger contracts going forward.

Our rationale behind using STA is that we would have been eliminated from the competition if (a) The products were controlled under ITAR as the company has four sources of equivalent cameras within the European Union (Xenics, Opgal, Raptor Photonics, and Sofradir)and (b) if a license was required every time a shipment was going to be sent.

The customer is stocking our products as one possible subsystem for their offering of a higher level product for strictly civilian uses. When an order arrives, having such inventory allows them to respond within a couple of weeks instead of the typical four to six months. In other words, stocking inventory gives them a delivery competitive advantage.

Our products was shown to be technically superior as well as priced competitively but without STA we simply would have not been selected, resulting in significant harm. Cancellation of STA as written under "Potential Revision" implies that we will lose all future revenues while empowering our competition.

In terms of the rationale given above by the government we find that the intent is already occurring and that cancellation of STA is not required. First, we submitted a Commodity Jurisdiction Request in order to have backup paperwork that supported that our products was a 6A003.b.4 item in the first place. After 6 months of waiting for government review we were informed by the Department of State of the determination. We then reviewed the STA tool on the Department of Commerce website and documented that our customer met all requirements and had them sign the prior consignee statement by the Chief Executive Officer of the company who in this case happens also to be a citizen of the United States so is bound by our laws. We reviewed this with DOC prior to shipment.

Finally when we shipped our first article via STA we have been contacted by the Department of Commerce and have provided all documentation including the prior consignee statement and passed a DOC review of same.

This is to demonstrate that (a) There is significant foreign competition that will take the business away from the United States since equivalent products exist within the target country (b) The government is informed during the process and that all key departments including the Department of Defense have had ample notification of the intended sale and use. Reporting after the fact has also been provided in writing to the Department of Commerce. The use of STA in this case allowed for a United States company to be competitive in a global marketplace and become a successful exporter of high technology equipment while still being within the Wassenar Agreement and safeguarding our ideals.

Thank you again for this opportunity to comment.

Sincerely,

Dr. Jonathan S. Kane
Clear Align, LLC
Chief Technology Officer

DRS Technologies, Inc.
Trade Compliance Office
2345 Crystal City Drive
10th Floor
Arlington, VA 22202

March 14, 2017

Mr. Christopher Costanzo
Office of National Security and Technology Transfer Controls
Bureau of Industry and Security
U.S. Department of Commerce
Washington, DC 20230

Subject: Response to the Notice of Inquiry (NOI) Requesting Comments for Increase in Controls: Infrared Detection Items, RIN 0694-XC035

Dear Mr. Costanzo,

DRS Technologies, Inc. appreciates the opportunity to comment on the Notice of Inquiry requesting comments for increasing the controls on infrared detection items. First, we would like to congratulate the Department for the final rule published 12 October 2016 regarding the export controls for infrared and laser items. Although the final rule is not perfect, we firmly believe that it draws a good balance between the industrial and national security needs of the United States.

Regarding the Notice of Inquiry, the proposal would significantly increase controls on many items that are widely available outside the United States, in countries that all control them lower than the U.S. even presently controls them. Given the detrimental effect on the commercial space industrial base when higher controls were applied to them despite foreign availability, we have significant concerns regarding the negative impact that such increased controls would have on the U.S. infrared industry.

In the joint Department of Defense and State report to the Congress regarding their recommendation to return the export control of commercial satellites to the Department of Commerce (re. the 1248 report), the Departments stated that

> "*Applying more stringent export control policies and practices than are imposed by other advanced satellite-exporting countries places the U.S. satellite industry at a distinct, competitive disadvantage that undermines the U.S. space industrial base to the detriment of U.S. national security, while doing nothing to protect the technological advances that are critical to giving our war fighters the advantages that U.S. technology can afford them.*"

The lessons learned from this are not limited to controlling as military items that are available commercially from other nations. These lessons are also applicable to applying more stringent commercial export control policies and practices than are imposed by those foreign countries.

For example, the discussion of changes to license exception STA would unilaterally require licenses to all destinations for commercial uncooled camera cores greater than 640x512 simply because such cameras might be larger than what the US military has in their ITAR regulated systems. Large format commercial infrared cameras and US military cameras (re. ITAR regulated) are disassociated thoughts. Such large format cameras are available commercially today from France and soon to be

China. There already exists a licensing requirement for commercial cameras being incorporated into military systems. Creating a licensing requirement for commercial cameras going into commercial systems simply because they have more pixels than a military camera in a military system lacks reason.

The proposal to eliminate the de minimis provision for all countries except Canada for non-US military items that incorporate certain infrared and night vision devices. We believe this recommendation to be unnecessary. The current regulatory approach requires a license to originally export the night vision devices for incorporation into such military items. Further, the de minimis provisions are prohibited to D5 countries. Given the Department licenses the original export, the items subject to the provisions are commercially available for many other countries outside the US, and the de minimus threshold is 25 percent, we believe the Departments current approach adequately balances the national security

Similarly, the proposal for a licensing requirement to retransfer or reexport uncooled infrared cameras with more than 75,000 elements would singularly place the U.S. at a distinct disadvantage. That number of elements would capture even the low quality infrared cameras using a 320x240 detector. Such detectors and the cameras that contain them are commonly available from hundreds of vendors located in dozens of countries, both within and outside of Wassenaar. Such a licensing requirement would further drive prospective non-US customers away from the US market, helping foreign manufacturers succeed at the expense of the US industrial base.

Additionally, the proposal contains several entries that would establish world-wide licensing requirements to include Canada. We strongly urge the department to reconsider this proposed requirement. Canada has been one of the strongest allies of the US and per the Defense Production Act, has been a part of the U.S. defense industrial base since 1950. Canada has a very well established and robust high technology industrial base, to include infrared technology. Such a licensing requirement would simply push Canada towards non-US sources for what is widely available from sources in Europe and the rest of the world.

As was evidenced in the US satellite industry, self-imposing significantly stricter export control policies and procedures will simply hamper or remove the US commercial infrared industry from the global market, conceding this market to already established foreign companies, enabling them to grow unchallenged by any U.S. competition. Already strong, competitive companies such as Dali and Wuhan-Guide in China, Ulis and Sofradir in France, Selex in the UK, SCD in Israel, NEC in Japan, Teledyne-Dalsa in Canada, and MikroSens in Turkey will continue to grow with the further hampering of U.S. industry from these well-established commercial markets.

We strongly urge the Department to abandon the ideas put forth in this Notice of Inquiry. The current regulatory controls for licensing, retransfers, and reexports more than adequately control these items to ensure the national security interests of the U.S. are addressed. It makes no sense for the United States to control these items at such a higher level when similar items manufactured overseas are not similarly controlled. U.S. companies must have the ability to compete on a level footing against this foreign competition. Enabling the global competitiveness of U.S. companies will foster growth, investment in new technology, and strengthen the U.S. industrial base. That will help to ensure a continued stream of advanced technology remains available to our nation, enhancing national security. As evidenced in the commercial satellite field, controlling these items as this rule proposes will have the opposite effect by inhibiting U.S. industry in an already well-established and growing international field.

Should you have any questions in this matter or require additional information, please contact me at (703) 412-0288 or at ghill@drs.com.

Sincerely,

Gregory C. Hill
Vice President
Global Trade Compliance
DRS Technologies, Inc.

Response to Department of Commerce

Bureau of Industry and Security

Docket Nr. 170106032-7037-01

RIN 0694-XC035

Comments Re: Section 734.4 "De Minimus US Content"

Potential Revision #2: Setting the upper limit of 75,000 pixels is not just an arbitrary number but, rather, is designed to penalize and further cripple US suppliers of commercial components, sub-systems and systems who have adopted world-wide format standards of 320x240 (76,800 pixels) or 320x256 (81,920 pixels). While the cost and inconvenience of complying with the 75,000 pixel limit will damage US producers seeking to comply, the resulting non-standard image format will assure US producers of a rapidly diminishing market for components, subsystems and imaging systems.

Most importantly, the recent US DoD and Marine Corps award of a $310M LTLM contract to Optics1 using 640x480 ULIS uncooled microbolometer detectors manufactured in France (with frame rates well in excess of 9 Hz and dynamic range well in excess of 56dB) demonstrate the rapid evolution of this technology internationally. Many of the proposed rule changes effectively punish US companies attempting to participate in a burgeoning international market for thermal imaging products.

Comments Re: Section 740.20 "Embedded"

The international marketplace for thermal imaging devices and subsystems is expanding at an extremely rapid pace. The world-wide auto industry, for example is moving rapidly towards self-driving vehicles that depend on "embedded" thermal imaging sensors as an essential part of the sensor package. These devices will certainly exceed the 75,000 pixel limit and must provide information at much higher rates than 9 Hz. Putting the proposed US government regulations in between US suppliers and international business such as automotive will guarantee that the thermal sensors and subsystems will certainly be acquired from foreign suppliers. The automotive industry is poised to be a dominant consumer of uncooled thermal imaging sensors, placing barriers to US suppliers participating in the automotive industry will relegate US industry to being an ever-shrinking player in the uncooled thermal imaging marketplace. Without the "flywheel" of massive commercial demand for uncooled thermal imaging sensors underwriting US producers, the US government will be forced to incur higher costs from the remaining suppliers for its needs, or purchase from foreign suppliers.

Comments Re: ECCNs 6E001 and 6E990

The existing and proposed limitations on production technology for microbolometer and readout integrated circuits are quickly being shown to be ineffective, unnecessary and ultimately, crippling for American suppliers and industry. Canada is not the real issue here. US suppliers of microbolometer devices, components and systems depend on cutting edge technology for the readout integrated circuit (ROIC) base wafers. The intellectual property and industry-leading design can all be accomplished in the US but manufacturing the ROIC silicon wafers must be done where the wafer fabrication technology exists – unfortunately increasingly in Asia. Limiting access to domestic and even, with a license under the revised rules, to Canadian silicon foundries is guaranteed to cripple and ultimately defeat US suppliers.

Comments: In general

Uncooled thermal imaging technology, devices and systems appear to be following in the footsteps of three earlier technologies, born with US DoD funding but gone from our shores for many years now. High density color liquid crystal displays, high performance CCD and CMOS visible imagers and GPS receiver chips were once deemed to be too important to the American warfighter and intelligence community to allow effective, commercial and international "productization". The result was predictable – all LCD's (and now OLEDs), silicon visible wavelength imagers and GPS chips for a wide variety of handheld devices are now designed, developed and produced in Asia. Can uncooled thermal imagers be far behind? It doesn't have to be. But …..

March 14, 2017

Submitted via www.regulations.gov

Dr. Christopher Costanzo
Sensors and Aviation Division
Bureau of Industry and Security
U.S. Department of Commerce
Washington, DC 20230

Subject: RIN0694-XC035; Comments of FLIR Systems, Inc., to the Notice of Inquiry, Increase of Controls: Infrared Detection Items (82 Fed. Reg. 4287, 13 January 2017)

Dear Dr. Costanzo,

FLIR Systems, Inc. ("FLIR") hereby submits the following comments to the Bureau of Industry and Security ("BIS") in response to the Notice of Inquiry ("NOI") and request for comments on the impact of increasing export controls on Infrared Detection Items under the U.S. Export Administration Regulations ("EAR"). These comments are timely submitted by the March 14, 2017 due date published in the Federal Register notice.

FLIR is a world leader in the design, manufacture, and marketing of sensor systems that enhance perception and awareness. FLIR's advanced thermal imaging and threat detection systems are used for a wide variety of imaging, thermography, and security applications, including airborne and ground-based surveillance, fugitive gas imaging, condition monitoring, research and development, manufacturing process control, search and rescue, drug interdiction, navigation, transportation safety, border and maritime patrol, and environmental monitoring.

FLIR employs over 1,800 people in 39 states, with additional employees around the world. Over the last three years, FLIR spent more than $400 million in research and development and introduced more than a hundred new consumer products in areas such as home security, firefighting, gas detection, agricultural yield improvement, automobile safety, energy monitoring and efficiency, search and rescue, and industrial maintenance and repair. In addition, FLIR develops products that help provide the U.S. warfighter with superiority over enemy combatants and life-saving situational awareness. Consequently, we understand the importance of appropriately controlling the export and reexport of uniquely military items and dual-use items. Approximately half of FLIR's annual revenue is generated by sales outside of the United States, and more than half of FLIR's annual revenue comes from sales to commercial users and applications.

Many of FLIR's products, software and technology are primarily controlled for export under Category XII of the ITAR and under ECCNs 6A002, 6A003, 6A990, 6A993, 6D002, 6D003, 6D991, 6E001 and 6E002 of the EAR. FLIR's competitors are largely foreign entities and compete with FLIR on a global basis, including in the United States. As a result, our continuing ability to invest in the development of new products and the growth of our business, as well as our ability to compete in the world marketplace, rests on the ability to efficiently export our products in accordance with applicable export control requirements.

Previously, FLIR provided public comments on BIS's first proposed rule corresponding to Category XII published on May 5, 2015 (80 FR 25798), and on the second proposed rule published on February 19, 2016 (81 FR 8421). We believe that BIS's final rule, which published on October 12, 2016 (81 FR 70320), improved upon the prior proposed rules. However, we still have significant concerns about the revisions made to the EAR, and we believe that the potential changes described in this NOI only further those concerns.

GENERAL COMMENTS

As a general comment, FLIR respectfully submits that the proposed controls are overly broad, and would introduce unnecessary complexity into the already complicated array of controls on Category 6 items. The combination of these proposed controls would be particularly damaging to FLIR's supply chain and overall business because FLIR (and its foreign subsidiaries) rely heavily on the availability of License Exception STA and appropriate application of the EAR's *de minimis* rules to be able to compete effectively in the global markets, and also to further FLIR's own long-term research and development and global manufacturing. In view of the substantial foreign availability of the focal plane arrays ("FPAs"), image intensifier tubes, read-out integrated circuits, and cameras that are the subject of these comments, FLIR believes that the overall impact of these proposed controls would be to incentivize FLIR's customers, including its own foreign subsidiaries, to use non-U.S. FPAs and cores in their production, which would result in significant loss of U.S.-based FPA production, and resulting loss in profitability, jobs, and U.S.-based technological investment. Further, we believe that these proposals would impose significant costs and burdens to U.S. industry, which would not be in accordance with Executive Order 13777 (Feb. 24, 2017) – "Enforcing the Regulatory Reform Agenda."

SPECIFIC COMMENTS

Potential Revisions to Section 734.4, "De Minimis U.S. Content" for 0A919 Foreign Military Commodities

As of December 31, 2016, the EAR provides that there is no *de minimis* level for non-U.S. made military commodities (as described in 0A919) that (1) include incorporated

infrared detection items in ECCNs 6A002, 6A003, 6A990 or 6A993.a, and (2) are destined for Group D:5 countries. The proposed revision would expand the destinations subject to the no *de minimis* provision to any destination, except Canada, when incorporating specified image intensifier tubes, FPAs and read-out integrated circuits ("ROICs"). The stated rationale for the proposed control is that the absence of U.S. controls could result in the export of potentially high performance systems incorporating U.S. components to a wide range of destinations outside of Country Group D:5 without U.S. Government review.

It is not clear whether this proposal would replace the current restrictions on the use of *de minimis* in § 734.4(a)(5), or whether it would supplement that existing section. Our assumption is that the proposal would supplement and not replace § 734.4(a)(5). With this understanding in mind, we believe this proposal is inconsistent with comparable EAR restrictions on the use of *de minimis*, imposes additional complexity and burden, and would further a competitive disadvantage for U.S. companies.

When BIS revised § 734.4(a)(5) in the October 12, 2016 final rule, the agency harmonized the *de minimis* treatment of certain dual-use infrared detection items with the *de minimis* treatment for U.S.-origin 600 series content incorporated into 0A919 foreign military commodities. It is unclear why BIS would change § 734.4(a)(5) to add more restrictive treatment for dual-use items than for 600 series items, which were previously subject to the ITAR and DDTC's see-through rule.

Further, this proposal adds burden and complexity to the analysis. U.S. exporters will now not only need to classify their item based on the parameters in the applicable ECCN, but they will also need to do a separate classification, purely for reviewing *de minimis* under this proposal, because some of the parameters used in this proposal (*i.e.*, figure of merit) are different than the parameters used in the applicable ECCN.

This proposal also groups NATO and other close allies, as well as Wassenaar countries, into the same treatment as Country Group D:5 countries. This is despite the fact that such allied countries have their own export licensing systems and would review reexports of this nature since the reexports would involve higher-level assemblies on the Wassenaar Arrangement Munitions List. Therefore, even though the U.S. Government would not review all reexports involving foreign military commodities, it is likely that the Wassenaar countries would conduct such a review, which should help reduce potential U.S. Government concerns.

As with many of the proposals in this NOI, this proposal would act as an additional deterrent to the incorporation of U.S.-origin FPAs, cores and cameras into foreign-manufactured systems. One of the main reasons for Export Control Reform was to reduce the incentive for non-U.S. companies to design out or avoid U.S. content, and this proposal would essentially institute an ITAR-like see-through rule, without any consideration for country of destination. Given the extensive foreign availability of

comparable dual-use image intensifier tubes, FPAs, and ROICs, foreign companies have considerable options in avoiding the complexity and burdens of U.S. export controls. A sample of such foreign availability is included as Exhibit A.

FLIR has attempted to quantify the impact on its business and on U.S. FPA production of the proposed changes to *de minimis* and License Exception STA (discussed in more detail below).

- For 2017, FLIR estimates $156.9 million of revenue will be affected by these changes.
- FLIR estimates $62 million in new R&D expense to reengineer its products (in compliance with applicable U.S. export controls) outside of the U.S. to use non-U.S. FPAs, cores and ROICs.
- FLIR estimates $67.5 million in lost profitability due to the increased cost of externally sourced FPAs.
- FLIR estimates 15% overall loss in U.S. uncooled FPA market share (and corresponding gain to foreign suppliers).
- FLIR estimates a $17.3 million loss in R&D funding associated with the lost revenues/volumes of U.S.-sourced detectors.
- FLIR further estimates that approximately 270 U.S. jobs may be lost as FPA production increases offshore including wafer fabrication and FPA production, but excluding capital equipment manufacturing.

FLIR therefore urges that BIS decline to adopt these additional proposed restrictions in § 734.4 on the use of the *de minimis* provisions for U.S.-origin dual-use infrared detection items incorporated into 0A919 commodities.

Potential Revisions to Section 740.20, License Exception STA for Certain Night Vision Equipment to be Embedded

As of December 31, 2016, the use of License Exception STA is substantially restricted for FPAs, ROICs, and related software and technology that are classified in Category 6 of the Commerce Control List. However, License Exception STA is still available for cameras controlled under ECCN 6A003 and is heavily used by FLIR and other U.S. companies. The proposed revision would remove STA eligibility for infrared cameras that are controlled under 6A003.b.4, and that (1) are being exported to be embedded in a higher level commercial assembly, system or equipment; and (2) incorporate two dimensional FPAs specified in either ECCN 6A002.a.3.c or ECCN 6A002.a.3.f, and that have more than 328,000 detector elements. The NOI states that the goal of this change is to ensure that the U.S. Government reviews exports of cameras that could exceed the size of those incorporated in military fielded systems, when exported for incorporation to commercial systems. This proposal goes well beyond even the very strict first proposed rule, which appeared to recognize the importance of using STA for 6A003 items.

FLIR respectfully submits that the proposed changes to Section 740.20 and the elimination of License Exception STA for certain cameras controlled under ECCN 6A003.b.4 will result in significant loss of commercial business and will make it extremely difficult for FLIR and other U.S. companies to sell products in the EU and Wassenaar member countries. Within the EU, FLIR and similarly situated U.S. companies already operate under a competitive disadvantage, as European companies sell these products within the EU without any restriction. With the significant foreign availability of 6A003 camera cores meeting the specifications in this proposal (see Exhibit A), companies in Country Group A:5 have numerous options for suppliers of such cores, without having to wait for the delay, uncertainty, and potential burdensome conditions associated with a license.

Section 744.9 already imposes a license requirement for exports, reexports, and transfers of 6A003 items to military end users or for incorporation into foreign military items. This proposal would therefore remove a robust license exception for exports and reexports to commercial end users in Country Group A:5 allied countries. The stringent requirements for use of this license exception include a Prior Consignee Statement, shipment notifications, and an agreement to permit U.S. Government end-use check. These requirements are so robust that customers frequently complain about the burdens and the restrictions that are imposed under License Exception STA. Essentially, STA is more like a "soft license" than an exception, except that it offers a more efficient and predictable alternative to licensing exports and reexports to civilian end-users for incorporation into commercial items in Country Group A:5. As a result, FLIR can offer its customers at least some degree of predictability and can commit to firm delivery dates for orders that meet the eligibility requirements.

FLIR also relies heavily on License Exception STA for its own intercompany sales and manufacturing. FLIR exports 6A003.b.4 cores and kits that meet the technical parameter in the proposed rule to its manufacturing subsidiaries in Sweden and Estonia. These cameras are then incorporated into commercial and civilian systems that are resold and exported in accordance with the export licensing requirements of EU member countries. The imposition of an additional U.S. licensing requirement before the cores may be exported would increase the administrative burden surrounding such exports and would introduce unpredictability into FLIR's supply chain. This would ultimately negatively affect customers, all without substantially furthering U.S. national security and foreign policy goals. The FLIR non-U.S. subsidiaries would be heavily incentivized to purchase their cores from non-U.S. suppliers, such as ULIS in France or sources in China (Guide GST, Iray, or Guang Wei Integrated Circuits), each of which would be eager to service FLIR's volume capability. This would not be a hypothetical exercise because FLIR's foreign subsidiaries have previously made business decisions to avoid FLIR U.S.-origin content based solely on U.S. export control issues. Previously, FLIR's foreign subsidiaries purchased ULIS FPAs instead of FLIR FPAs because of the concern that U.S.-origin FPAs would taint the non-U.S. origin commercial product due to the ITAR's see-through rule. The FLIR subsidiaries made this decision despite the fact

that the ULIS FPAs were more than double the cost of FLIR's own FPAs. Consequently, this decision resulted in revenue for a foreign competitor and required additional configuration management and expense. If STA is removed, it is very possible that a similar decision could be made by a non-U.S. company based solely on U.S. export controls rather than on price and quality.

Additionally, the imposition of this licensing requirement increases the complexity of the export regulations and does not further the goals of either the Obama Administration's Export Control Reform effort or the new Administration's push to reduce regulatory burdens even further. Exporters of controlled cameras already must wade through a complicated matrix of technical parameters, countries, end-users, end-uses, and documentation to make a licensing determination and to advise customers of delivery times. The proposed requirement adds yet another technical parameter, and will require exporters to determine whether the cameras will be embedded into a higher level assembly, system or equipment before accepting an order. The proposed revision will make it even more difficult to confirm that License Exception STA applies to a transaction and may discourage exporters from relying on its use even when it may be available.

In fiscal year 2016, FLIR exported and re-exported more than $25 million worth of 6A003.b.4 cameras under License Exception STA. A significant portion of such sales would be at risk without the availability of License Exception STA because competitors would be able to supply similar products without the delays and other issues associated with needing an individual license to export and reexport such items. We do not see any need to eliminate a robust license exception for exports and reexports to commercial end users and end uses in allied countries when there is extensive foreign availability. STA has been available for 6A003 cameras since the license exception was created, and we are not aware of any major compliance issues regarding its use for 6A003 items. Consequently, FLIR respectfully submits that this proposed revision to License Exception STA should be rejected.

Potential Revisions to ECCN 6A993

Prior to December 31, 2016, the export, reexport or transfer of 6A993.a cameras (9 Hz and below) required an export license only in very limited circumstances. The licensing requirements were in line with those imposed by the EU and Wassenaar member countries, and so U.S. companies could reasonably compete with EU and other global suppliers of 9 Hz products, although most foreign competitors offer higher performing products operating at 50 Hz rather than 9 Hz.

As of December 31, 2016, the export controls for 6A993 products were greatly expanded to require licenses for all countries (except Canada) when destined to a "military end user," or for incorporation into a foreign military commodity. The new proposal would extend those controls even further, to capture 9 Hz camera cores that

will be incorporated in imaging cameras for civil end-users or civil commodities, when destined for export, reexport or in-country transfer to or in a D:5 country. The proposal requires a license for (1) cameras that meet the requirements of Note 3 to 6A003.b.4; and (2) incorporate a microbolometer FPA with greater than 75,000 detector elements. The rationale stated for this new control is that such 9 Hz camera cores could be incorporated in imaging cameras for civil end-users and civil commodities, such as (1) night vision thermal monoculars that could be used as weapon sights and (2) civil UAVs.

FLIR respectfully submits that the proposed changes to 9 Hz cameras in ECCN 6A993.a are overly broad and will further exacerbate the competitive disadvantage regarding the 9 Hz restriction that U.S. companies face by imposing additional export controls on low end thermal imaging products for which there is extensive foreign availability. These proposed changes will also increase the complexity of the export regulations and compliance burden to exporters, while doing little to advance U.S. national security and foreign policy interests.

This new, broad-based control captures equally 9 Hz thermal camera products for the consumer and retail markets and camera cores that may be used in a variety of foreign manufacturing activities. FLIR has many 6A993.a 9 Hz thermal imaging camera products that have been designed for commercial, recreational and industrial markets, are not for military applications, and are widely sold to individual consumers through distribution at retail stores and online sites.

Although the new controls in § 744.9 have been in effect for only a few months, their impact on sales of 9 Hz U.S.-origin cameras is a good indicator of the impact that this new proposal would have. First, the new controls and associated export compliance measures have significantly negatively affected FLIR's competitive position with respect to 9 Hz products, as distributors and other customers within the EU countries do not want to purchase products encumbered by such U.S. controls, when they can buy equivalent (or better – at higher resolutions, sensitivities and frame rates) cameras from European and Asian suppliers. As part of Exhibit A, we have provided examples of foreign availability of 6A003 and 6A993.a cameras to show the wide availability and ease of obtaining such cameras, often without a license, depending on the camera and the countries involved. This also includes foreign availability for applications of concern, as described by the NOI for this proposal. Next, we have found that distributors do not want to assume additional responsibility and liability for compliance with U.S. controls when reselling low-end thermal products with lower price points. The revisions to § 744.9 added an in-country transfer license requirement for the first time, and this now adds *extensive* compliance responsibilities for foreign distributors that they do not want to handle and can easily avoid, again, with the existence of numerous non-U.S. origin cameras. Lastly, distributors do not want to complete documentation and wait for an export license when such products are sold incidentally to military end-users, especially when the distributor would not need to obtain a license from its local government for the same transaction.

Because of these concerns, we strongly believe that adding additional license requirements to 9 Hz cameras will further exacerbate the already significant competitive disadvantage that U.S. companies face in the world market. We estimate that we will lose more than $12 million in commercial sales to Chinese suppliers alone if the proposed changes were to become final.

Additionally, the broad definition of "military end user" is problematic and requires an exporter or reexporter to individually review each proposed sale. Despite notification from FLIR, customers may not realize that some end users, such as national police or coast guard, are designated as "military" under the new U.S. rule, and may not report them as such. All proposed sales of 9 Hz products now require substantial additional due diligence, research and inquiries to customers that require exporters to spend more time and money on compliance and have a chilling effect on sales to all countries. In FLIR's view, the burden of this additional control, extended as it is to all countries (except Canada), far outweighs its advancement of U.S. national security interests.

In FLIR's view, the extension of this control to cameras for all civil end-users and civil commodities in these countries is overly broad, and will substantially decrease FLIR's sales of these products in those countries. We do not expect that our customers in these countries will accept a licensing requirement for civil end users and commodities. For example, China is by far the largest market in Country Group D:5 that would be affected by this proposal. A Chinese company could easily source, without the need for a license, a 9 Hz camera from a number of non-U.S. companies, including Chauvin Arnoux (France), Cordex (UK), i3system (South Korea), Testo (Germany), and Therm-App (Israel). Additionally, and perhaps more importantly, a Chinese company could source a 6A003 camera operating at a frame rate of 50 Hz and using a French or Chinese FPA from companies within China, including BritIR, KEII (Guangzhou Keii Electro Optics Technology Co., Ltd.), Wuhan Guide, Dali, Sun Creative Technologies, and North Guang Wei Technologies. A sample of brochures from these Chinese companies and other Chinese-made products is included as Exhibit B. Consequently, these cameras/cores are widely available from foreign manufacturers, including within China from Chinese companies, so the control would not be effective in providing the U.S. Government with visibility into exports and reexports of 9 Hz cameras. It would just exclude U.S. companies and U.S.-made products from the market.

If any changes should be made to controls affecting 9 Hz cameras in 6A993.a, then we recommend that the agencies revisit the revisions to § 744.9. As previously mentioned, the controls that went into effect on December 31, 2016, are already having a substantial negative impact on sales of 9 Hz cameras in countries (such as those in Europe) that should not be of significant concern for export control purposes involving less-sensitive items. As a result, if <u>any</u> change should be made to export controls for 6A993.a items, FLIR strongly recommends that § 744.9 be revised to exclude 6A993.a 9 Hz cameras.

Potential Revisions to ECCNs 3C001 and 3E001

As has been discussed in our response to many of the potential revisions described in the BIS NOI, FLIR and other U.S. companies already face an un-level playing field with non-U.S. companies. One of the primary reasons is that U.S. export controls for dual-use infrared detection items are applied differently than the Wassenaar dual-use controls applied by most allied countries. The most effective export controls are those that are multilateral. If unilateral export controls are warranted, they are most effective when the U.S. has a clear and significant advantage in the development and production of the affected items.

Items in ECCNs 3C001 and 3E001 are currently controlled for NS Column 2 and AT Column 1 reasons, which do not impose a license requirement for allied countries like those in Europe, Japan, South Korea, Australia, and New Zealand. The proposal to add an RS Column 1 reason for control will impose a license requirement for such allied countries and create a different level of control than that already established by Wassenaar. Once again, adding a license requirement for allied countries will further provide non-U.S. companies with a competitive advantage.

Before proceeding with this proposed revision, we recommend that the agencies work to develop a Wassenaar proposal to (1) ensure that the proposal is fully within the scope of 3C001 (and 3E001) as it seems that some of the material descriptions in the proposal do not completely fit within 3C001.d, (2) ensure that the materials and related technology described are only used for producing 6A002 focal plane arrays and would not inadvertently capture other commercial processes, and (3) impose a more effective multilateral control, rather than a less effective unilateral control.

Potential Revisions to ECCN 6E001, 6E002 and 6E990

The proposed rule would add a worldwide RS control for specific development and production technology related to components controlled under ECCNs 6A002 or 6A990, such that licenses would be required for Canada. Such a worldwide RS control would be a radical departure under the EAR, as almost all items subject to the EAR do not require a license for Canada. Further, this potential revision attempts to reconstitute a proposal from the first proposed rule that was roundly rejected by the public, and the interagency review appeared to concur with that conclusion based on the second proposed rule and subsequent final rule. We are concerned that a similar potential revision is being considered now.

First, we are concerned that requiring a license for this technology will further the competitive disadvantage that U.S. companies face for infrared detection items. In collaborating with a customer, it is essential for any company to be able to have technical discussions. Under this proposal, U.S. companies would need to obtain a

license prior to technical discussions with Canadian companies. European and Asian companies would be able to have such technical discussions without needing to obtain a license since such technology is not controlled to Canada under their local law. As a result, this disparity adds an incentive for Canadian companies to source FPAs, image intensifier tubes, and ROICs from non-U.S. companies. Exhibit A provides additional information demonstrating the foreign availability of such items. We would also note that this foreign availability includes one Canadian company, Teledyne-DALSA, which has the capability to develop and produce uncooled FPAs up through 640x512.

Within FLIR, this new control for Canada would impose additional burdens in the form of needing to obtain a license to release this technology to our Canadian facility and to our Canadian national employees working in the United States. Under this proposal, new licenses would be required, despite the fact that these persons already have access to this same technology today under the NLR designation.

Further, we believe it is important to point out the severity of this proposal for certain 6E990 technology. Essentially, the EAR would treat such technology as if it was ITAR-controlled, even though the technology was EAR99 prior to December 31, 2016. All other countries currently treat this technology as being comparable to EAR99, and would not require a license to any destination other than embargoed countries. We do not see how imposing a license requirement for export of this technology to Canada would further U.S. objectives, as there is extensive foreign availability, and no other country considers this technology to even be dual use.

Finally, we do not believe that imposing a license requirement for Canada for certain 6E001, 6E002, and 6E990 technology furthers the national security and foreign policy interests of the United States. This proposal ignores the longstanding U.S.-Canada defense relationship and integrated North American industrial base. Imposing a new license requirement hinders military interoperability and our important economic relationship. In light of Canada's extensive cooperation with the United States in export controls, we believe that any potential concerns should be addressed with Canadian counterparts, rather than by imposing an unnecessary and burdensome license requirement.

CONCLUSION

We greatly appreciate the extensive efforts that the interagency drafters and reviewers have put into the rewrite of Category XII and related controls in the EAR. For the reasons stated above, we believe that all of these proposals would further the competitive disadvantage that U.S. companies face in the global commercial infrared detection market, increase complexity and burden, and not advance U.S. national security and foreign policy interests. We hope that these comments will assist the agencies in how to proceed with Category XII and corresponding controls in the EAR.

Please contact Todd DuChene, Senior Vice President and General Counsel, by phone at 503-498-3318, or by e-mail at todd.duchene@flir.com; or Nancy Boughton, Vice President & Deputy General Counsel, by phone at 503-498-3301, or by e-mail at nancy.boughton@flir.com, should you require any further information in support of our comments herein.

Best regards,

(by fax)

Andrew C. Teich

Andrew C. Teich
Chief Executive Officer

Exhibit A

Exhibit A – Sample of Foreign Availability for 6A002, 6A003, 6A990, and 6A993.a Items

6A002 – Focal Plane Arrays

Uncooled

- Ulis (France): uncooled infrared FPAs up through 1024x678
- Semi-Conductor Devices (SCD) (Israel): uncooled FPAs up through 640x480
- NEC Avio Infrared Technologies Co. Ltd. (Japan): uncooled FPAs up through 640x480
- Wuhan-Guide (China): uncooled FPAs up through 640x512
- Zheijang Dali Technology Co. (China): uncooled FPAs up through 640x512
- Debut Optoelectric Sensor Co. (China): uncooled FPAs up through 320x240
- Fraunhofer IMS (Germany): uncooled FPAs up through 320x240
- MikroSens (Turkey): uncooled FPAs up through 160x120
- Teledyne-DALSA (Canada): uncooled FPAs up through 640x512
- i3 Systems (South Korea)

Cooled

- Semi-Conductor Devices (SCD) (Israel), 1920x1536 InSb, MWIR; 640x480 SWIR FPA
- Sofradir (France), 640x480 SWIR FPA
- Selex (UK): 1280x720 MCT
- IR Nova (Sweden): 640x480 T2SL FPAs
- Wuhan Guide (China): cooled FPA and modules
- AIM INFRAROT GmbH (Germany): 640x512 MCT
- Xenics (Belgium)

6A002 – Image Intensifer Tubes

- Photonis (France/Netherlands)
- Harder ProxiVision (Germany)
- Hamamatsu (Japan)
- Katod (Russia)
- Ekran (Russia)
- Melz (Russia)
- Hioptic (China)
- NORINCO (China)
- Acuri Tech (Taiwan)
- BEL (India)

6A003 – Cameras

- NEC Avio Infrared Technologies Co. Ltd. (Japan)
- Chauvin Arnoux (France)
- Zheijang Dali Technology Co. (China)
- HT Italy (Italy)
- Infratec (Germany)
- Jenoptik (Germany)
- Avio (Japan)

- SAT (Satir) (China)
- Testo (Germany)
- Wuhan-Guide (China)
- Xenics (Belgium)
- Sofradir (France)
- Hamamatsu (Japan)
- COX (South Korea)
- ULIRvision (China)
- Sunma IR Tech (China)
- Thermotecknix (UK)
- Xi'an Gatherstar (China)
- Beijing Hamilton (China)
- Opgal (Israel)
- Allied Vision (Germany)
- Raptor Photonics (Ireland)
- Telops (Canada)
- Andor (UK)
- Photonic Science (UK)
- LaVision (Germany)

6A990 – Read-Out Integrated Circuits

- Xenics (Belgium)
- Sofradir (France)
- Sagem (France)
- Selex (UK)
- sInfraRed (Singapore)
- Alcatel-Thales (France)
- New Imaging Technologies (France)
- ChungHwa/Leading-Light (Taiwan)
- Semi-Conductor Devices (Israel)
- Mikro-Tasarim (Turkey)
- Dali-Technologies (China)
- Wuhan-Guide (China)
- Tumsis (Turkey)
- Imec (Belgium)

6A993.a – 9 Hz Cameras

- Chauvin Arnoux (France)
- Cordex (UK)
- i3 Systems (South Korea)
- Testo (Germany)
- Therm-App (Israel)
- BritIR (China)
- KEII (Guangzhou Keii Electro Optics Technology Co., Ltd) (China)

- Wuhan Guide (China)
- Dali (China)
- Sun Creative Technologies (China)
- North Guang Wei Technologies (China)

Exhibit B – Part 1

广微积电

Beijing Guang Wei Integrated Circuits,Inc

非制冷型红外焦平面探测器及机芯组件

Uncooled Infrared LWIR Detector and Cores

eijing Guang Wei Integrated Circuits,Inc

中国·北京

公司简介
Company introduction

北京广微积电科技有限公司于2006年成立，致力于高端数模混合集成电路及MEMS（微机电）传感器和驱动器的研制生产。凭借雄厚的资金实力、先进的管理制度、首屈一指的研发团队，自公司创始至今，成功突破了多项行业内技术难题，实现了高精度技术的规模化生产应用。在国内同行业中处于领军单位。

非制冷红外焦平面成像技术作为一项高尖端技术，可以在各个领域特别是军事领域发挥非常重要的作用，也因此成为西方国家对中国长期禁运的核心技术之一。北京广微积电科技有限公司自成立之初就立足于突破西方对我国的技术封锁，努力缩短国内与西方先进技术之间的差距。公司利用自身的优势和技术基础，在很短的时间完成了非制冷红外焦平面传感器从研制到稳定批量生产的全过程，性能指标达到了国际先进水平，成为国内唯一一家有能力提供核心器件的非制冷红外焦平面传感器生产厂商。

Founded in 2006, BeiJing GuangWei Integrated Circuits Inc. (GWIC) specializes in developing, and producing of high-end mixed signal integrated circuits (IC), MEMS, sensors and actuators. With strong financial support-systems, advanced management systems, pre-eminent R&D team, GWIC has made a breakthrough in a number of technical problems within the industry and achieved high-precision large-scale production and application. At present, the company has been one of the market leaders in Chinese same line whatever from the viewpoint of ability of production and design, or from ability of quality guarantee.

As a highly sophisticated imaging technology, uncooled infrared focal plane can play an important role in various fields, especially in the military. As a result, the United States and Western countries imposed an all-round blockade and embargo against China. Since its establishment, GWIC aims to break the blockade of foreign technology and narrow the gap with foreign advanced scientific and technical level. Taking full advantage of it' s own strengths and technology, the company realizes the production of the uncooled infrared focal plane with the international advanced performance in a short time. GWIC is now becoming the only one manufacturer capable of providing the uncooled infrared focal plane cores in China.

| 客户至上 | 信誉第一 | 以人为本 | 技术创新 |

北京广微积电科技有限公司

Beijing Guang Wei Integrated Circuits, Inc

公司地址：北京市朝阳区建国门外大街甲6号中环世贸中心C座5层

联系电话：010-65630588

传　　真：010-65630866

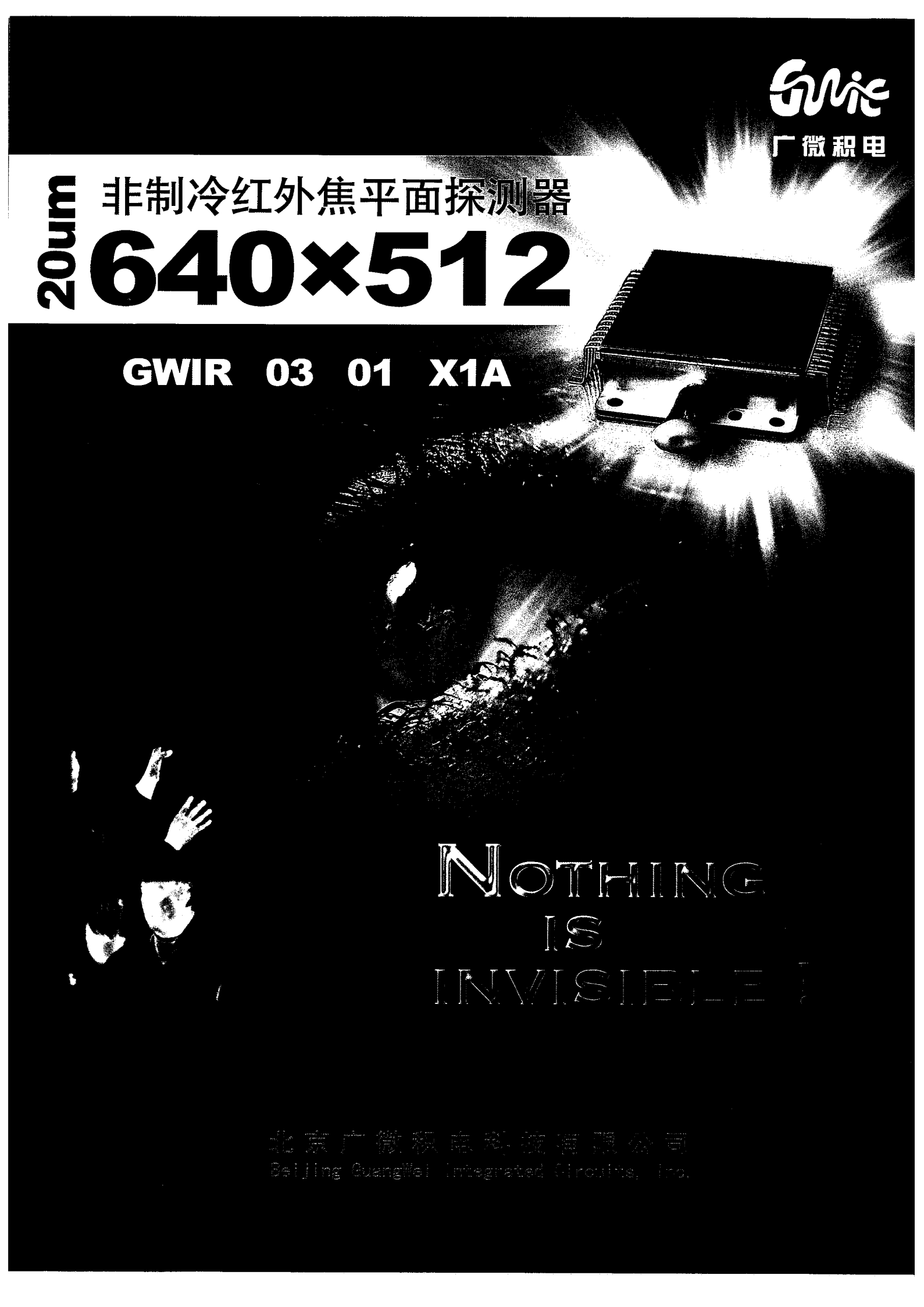
网　　址：www.gwic.com.cn

GWIC
广微积电

20um 非制冷红外焦平面探测器

640×512

GWIR 03 01 X1A



NOTHING IS INVISIBLE!

北京广微积电科技有限公司

Beijing Guangwei Integrated Circuits, Inc.

GWIC
广微积电

38um 非制冷红外焦平面探测器

160×120

GWIR 01 02 X2A

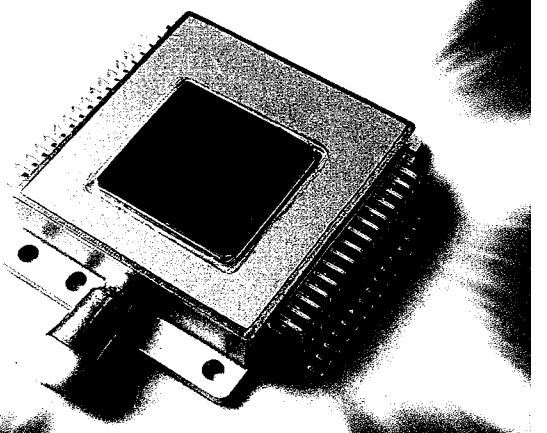
NOTHING IS INVISIBLE!

北京广微积电科技有限公司
Beijing Guangwei Integrated Circuits, Inc.

GWIC
广微积电

45um 非制冷红外焦平面探测器

160×120



GWIR 01 01 21A

NOTHING IS INVISIBLE

北京广微积电科技有限公司

Beijing Guangwei Integrated Circuits, Inc.

非制冷红外探测器机芯组件

产品分类及性能指标

★GW-1型机芯组件

组成	探测器板 + 模拟板 + DSP 板 + 电源板
功能	图像自动增益和偏移 图像手动调节增益和偏移 2 倍电子变倍 8 种极性（白热、黑热、6 种伪彩色） 十字分划显示（射表） 电池电量显示
接口	4 个控制按键 1 路 RS232 串口 3 路 PAL 制模拟视频输出 2 路电机驱动输出

★GW-2型机芯组件

组成	探测器板 + FPGA 板 + 电源板
功能	图像自动增益和偏移 图像手动调节增益和偏移 2 倍、4 倍电子变倍 8 种极性（白热、黑热、6 种伪彩色） 十字分划显示（射表） 电池电量显示
接口	4 个控制按键 2 路 RS422 串口 1 路 LVDS 数字视频输出 3 路 PAL 制模拟视频输出 2 路电机驱动输出

非制冷红外探测器机芯组件

★ GW-3型机芯组件

组成	探测器板 +FPGA 板 +DSP 板 + 电源板
功能	图像自动增益和偏移 图像手动调节增益和偏移 2 倍、4 倍电子变倍 8 种极性（白热、黑热、6 种伪彩色） 十字分划显示（射表） 电池电量显示 测温分析功能 目标识别跟踪功能 可见光图像采集 红外与可见光的融合、画中画 SD 卡存储 录音放音 激光指示器驱动 充电管理
接口	4 个控制按键 2 路 RS422 串口 1 路 LVDS 数字视频输出 1 路 USB2.0 接口 3 路 PAL 制模拟视频输出 2 路电机驱动输出

★ GW-4型机芯组件

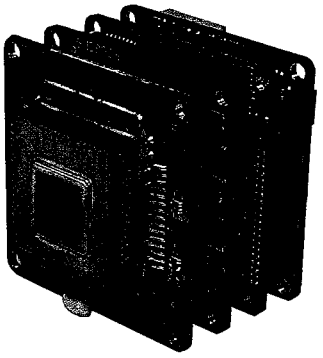
组成	探测器板 +FPGA 板 +DSP 板 + 电源接口板
功能	图像自动增益和偏移 图像手动调节增益和偏移 1～8 倍连续电子变倍（步长 0.1） 8 种极性（白热、黑热、6 种伪彩色） 十字分划显示（射表） 电池电量显示 测温功能 目标识别跟踪功能 测温分析功能 目标识别跟踪功能 可见光图像采集 红外与可见光的融合、画中画 SD 卡存储 录音放音 激光指示器驱动 充电管理
接口	4 个控制按键 1 路 RS485 串口 1 路 LVDS 数字视频输出 1 路 USB2.0 接口 1 路以太网接口 3 路 PAL 制模拟视频输出 2 路电机驱动输出

广微积电
Beijing Guang Wei Integrated Circuits,Inc

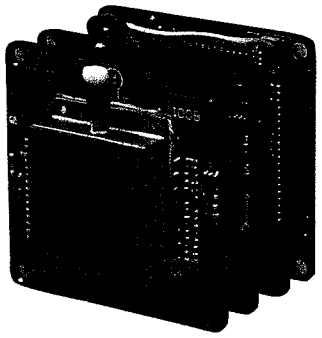
非制冷红外探测器机芯组件

GW系列非制冷红外探测器机芯组件

GW系列非制冷红外探测器机芯组件，采用我公司自主研发的GWIR系列氧化钒（VOx）非制冷红外焦平面探测器并配套有功能强大的多用途通用型红外成像电路，可实时显示高清晰度的红外图像。



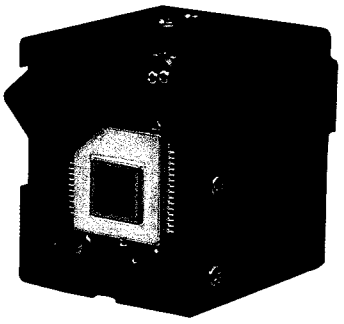
GW160A



GW384A

产品特点

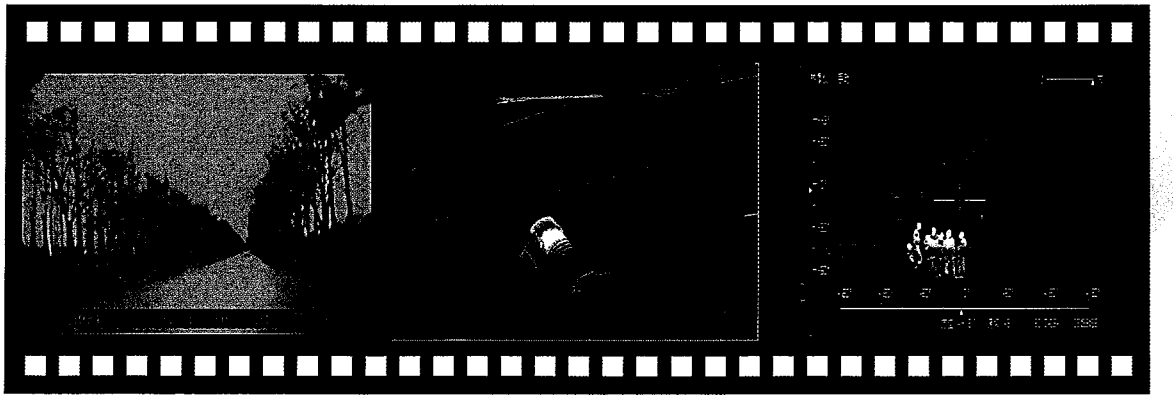
- 自主知识产权；
- 高灵敏度，高帧频；
- 接口丰富，扩展性强；
- 功能强大，便于集成；
- 体积小、重量轻、功耗低、可靠性高；
- 可按用户需求定制。



GW160A

产品应用领域

夜间观察、导航，安防监控，工业预防性维修。



GWIC
广微积电

传感器材料	VOx
面阵分辨率	384×288
像元中心距	35um
填充系数	70%
响应波段	8～14um
*温度灵敏度	(NETD@1/f，300K，50Hz)
GWIR 02 01 21A	≤80mK
GWIR 02 01 31A	≤60mK
典型热响应时间	7ms
盲元率	<0.1%
典型响应率	4-8mV/K
最大帧频	60Hz
动态范围	≥70dB
输出信号	单通道模拟信号
典型功耗 (不包括TEC功耗)	200mW
工作温度范围	-40℃～+60℃
存储温度范围	-55℃～70℃
重量	≤15g

*备注：厂家可以根据用户对性能和成本的要求提供不同级别NETD的探测器，产品型号GWIR 02 01 X1A中的“X”代表了该探测器的NETD水平。

地址：北京市朝阳区建国门外大街甲6号中环世贸 C座 5层
电话：010-65630588 传真：010-65630866 邮编：100022
网址：www.gwic.com.cn Email：sales@gwic.com.cn

GWIC
广微积电

传感器材料	非制冷氧化钒（VOx）
面阵分辨率	160×120
像元中心距	45um
填充系数	70%
响应波段	8~14um
温度灵敏度(NETD)	≤80mK
典型热响应时间	7ms
盲元率	<0.1%
典型响应率	4-8mV/K
最大帧频	60Hz
动态范围	≥70dB
输出信号	单通道模拟信号
典型功耗（不包括TEC功耗）	200mW
工作温度范围	-40℃~+60℃
存储温度范围	-55℃~70℃
重量	≤25g

地址：北京市朝阳区建国门外大街甲6号中环世贸 C座 5层
电话：010-65630588 传真：010-65630866 邮编：100022
网址：www.gwic.com.cn Email：sales@gwic.com.cn

GWIC
广微积电

传感器材料	VOx
面阵分辨率	160×120
像元中心距	38um
填充系数	70%
响应波段	8～14um
*温度灵敏度	(NETD@1/f，300K，50Hz)
GWIR 01 02 22A	≤80mK
GWIR 01 02 32A	≤60mK
典型热响应时间	7ms
盲元率	<0.1%
典型响应率	4-8mV/K
最大帧频	100Hz
动态范围	≥70dB
输出信号	单通道模拟信号
典型功耗（不包括TEC功耗）	200mW
工作温度范围	-40℃～+60℃
存储温度范围	-55℃～70℃
重量	≤15g

*备注：厂家可以根据用户对性能和成本的要求提供不同级别NETD的探测器，产品型号GWIR 01 02 X2A中的“X”代表了该探测器的NETD水平。

地址：北京市朝阳区建国门外大街甲6号中环世贸C座5层
电话：010-65630588　传真：010-65630866　邮编：100022
网址：www.gwic.com.cn　Email：sales@gwic.com.cn

广微积电

传感器材料	VOx
面阵分辨率	640×512
像元中心距	20um
填充系数	90%
响应波段	8～14um
*温度灵敏度	(NETD@1/f，300K，50Hz)
GWIR 03 01 21A	≤80mK
GWIR 03 01 31A	≤60mK
典型热响应时间	7ms
盲元率	<0.1%
典型响应率	4-8mV/K
最大帧频	60Hz
动态范围	≥70dB
输出信号	双通道模拟信号
典型功耗（不包括TEC功耗）	250mW
工作温度范围	-40℃～+60℃
存储温度范围	-55℃～70℃
重量	≤25g

地址：北京市朝阳区建国门外大街甲 6 号中环世贸 C 座 5 层
电话：010-65630588 传真：010-65630866 邮编：100022
网址：www.gwic.com.cn Email：sales@gwic.com.cn

TK-3头盔式热像仪

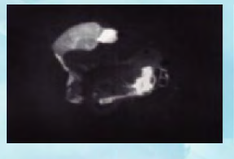
TK-3型头盔式热像仪是便携式夜间观察装备，可在完全黑暗无任何光照的情况下发现和观察目标，执行反恐、搜救、消防等任务，广泛应用于须在黑暗和烟雾较强的环境下作业的单位和部门。

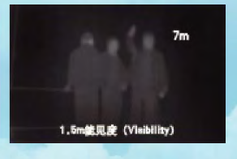
产品特点

- 采用非制冷红外焦平面探测器，使用寿命长、可靠性高、体积小、重量轻、功耗低、性价比高、使用维护简便。
- 与微光夜视、主动红外夜视仪相比，探测距离远，灵敏度高，不需要任何光照，穿透烟雾能力强、能识别多种伪装、被动探测、隐蔽性好。
- 不怕强光照射和干扰。
- 解放使用者双手，便于操作装备（设备）及实施救援。
- 采用模块化设计，单双目镜可选，单目镜左右眼观察位置可调。
- 固定方式简便，适应各型头盔且不破坏头盔结构。

产品应用

- 军事及反恐–可确保在全黑暗环境、有烟雾及强光干扰下可靠使用，执行军事作战及反恐任务。
- 野外及海上搜救–热敏感度高、系统视场大，能够快速发现待救人员，可广泛应用于灾害救援，救助打捞，辅助生命探测。
- 消防及救灾–长波红外探测，穿透烟雾力强，在火灾抢险中能够迅速准确搜救人员，有效保障生命安全，提高灭火效率，并能有效发现隐火，避免再次复燃。

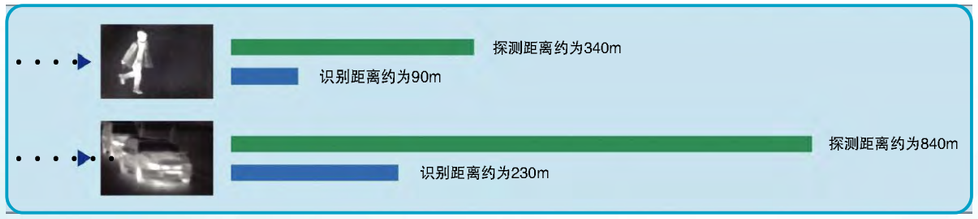




产品性能指标

探测器类型	非制冷红外探测器
观察视场	41° ×31°
输出制式	PAL
显示方法	单筒观察目镜或双目镜
工作温度	-20～+60℃
工作电源	DC7.4V

作用距离(夜间、一般气象条件)



热成像仪和微光夜视仪、主动近红外摄像机的使用性能比较

产品类型	微光夜视仪	主动近红外摄像机	热成像仪 (非制冷探测器)
探测距离	较远	较近	远
穿透烟雾能力	不好	不好	较好
能否承受强光照射	不能	受影响	能承受
是否需要光照	需月光、星光	自身光照	不需要
能否辨别伪装	不能	不能	能辨别多种伪装
能否感受景物温度	不能	不能	能
观察隐蔽性	较好	不好	好
使用寿命	较短	较长	长

北京广微积电科技有限公司
Beijing Guang Wei Integrated Circuits, Inc
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联系电话： 010-65630588
传　　真：010-65630866
邮　　编：100022

红外安防监控系统

安防监控系统采用多种型号的红外热像仪进行系统组网，能够在全黑暗和有烟雾等能见度低的环境中看清远处的人和物体，广泛应用于政府、军队、银行、仓库、豪宅、码头、机场、边境、海关及海岸线等重要场所的昼夜安防监控。

产品特点

- 红外热像仪采用非制冷红外焦平面探测器，使用寿命长、体积小、重量轻、功耗低、性价比高、维护简便。
- 在有烟雾和完全黑暗的环境下能对目标进行观察和监视。
- 被动监视，观察隐蔽，识别伪装能力强。
- 探测距离远超过近红外和微光类夜视产品。

JK–100A

JK–10A　JK–18A　JK–25A　JK–35A

JK–50A

产品应用

- 标准电源、控制、通讯及视频接口，便于接入现有各种安全监控网络。
- 热像仪可多点设置，集中控制，系统组网，多种方案可选。
- 可根据不同用户需求，提供多种自动报警手段。
- 提供8种伪彩色选择，2倍电子放大，红外镜头视场从70度-4度可供选择，探测距离可从几十米到数公里，加装云台后搜索范围可达到水平360度，俯仰90度。
- 机动式安防监控系统，可快速移动布控，采用有线或无线传输，远距离监控，易于装卸便于携带。
- 可提供红外及可见光等多传感器同步监控，配有大容量视频存储设备，便于资料的保存及执法取证。

JK–150A

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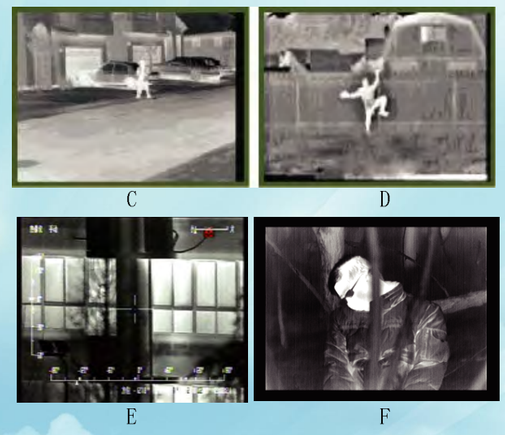
热像仪系列产品的焦距、视场、探测距离

类型	产品型号	焦距	视场	探测距离(对人)	探测距离(对小车)
近距大视角观察型	JK–10A	10mm	67.8　5 3. 5	≥192m	≥460m
	JK–18A	18mm	40.5　3 1. 3	≥346m	≥830m
中距观察型	JK–25A	25mm	30.1　2 2. 8	≥479m	≥1160m
	JK–35A	35mm	21.7　1 6. 4	≥671m	≥1620m
	JK–50A	50mm	15.3　1 1. 5	≥958m	≥2320m
中远距观察型	JK–100A	100mm	7.7　5 . 8	≥1917m	≥4640m
	JK–150A	150mm	5.1　3 . 9	≥2860m	≥6930m

热成像观察效果

- 图（a）是利用热像仪探测丛林中可疑人员的图像，
- 图（b）是用可见光摄像机同时观察相同区域的图像。



- 图(C)(D)(E)(F)是监控视频图像

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CZ-10A 、CZ-18B车载红外夜视仪

CZ-10A 、CZ-18B车载红外夜视仪，能够使驾驶者在完全黑暗及有烟雾等复杂气象条件下清楚地观察道路及周边环境，保障行人及驾驶安全；可实现军警车辆特殊需求条件下的无灯光驾驶；通过配置云台设备，能对周边环境进行隐蔽观察、搜索和监控。

CZ–18B

产品特点

- 采用非制冷红外焦平面探测器，图像分辨率高，使用寿命长、体积小、重量轻、功耗低、性价比高、使用维护简便。
- 有效观察距离是车前大灯视距的三倍，观察视野是车灯角度的四倍。
- 在烟雾情况下，观察距离可达正常视距的7-20倍。
- 可避免夜间会车时，强光照射引起的暂时性视盲、眩目所导致的危险。
- 被动监视，观察隐蔽，识别伪装能力强,也能进行全天候观察。
- 采取"三防"措施，保证产品在恶劣环境中可靠工作。

CZ–10A

产品应用

- 安装灵活，可根据需要采用嵌入式固定安装或顶置式便携安装方式。
- 显控装置可采用车载液晶显示屏或隐蔽性更好的双目镜方式进行观察和控制。
- 有多种镜头可选，加装升降机构和云台，可实现远距离、大范围搜索和观察。

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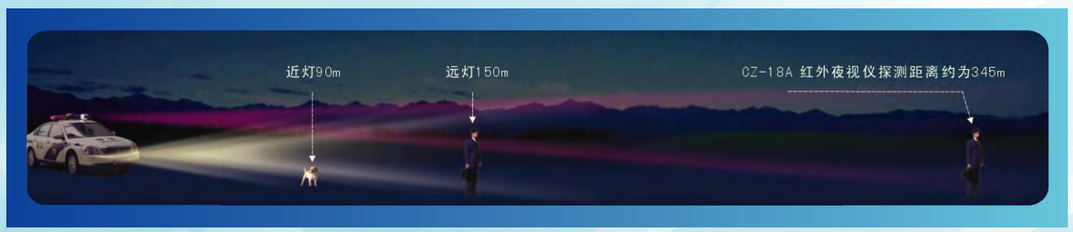
产品性能指标

探测器类型		非制冷焦平面微型测辐射热计	
型 号		CZ-10A	CZ-18B
空间分辨率		3.09mr	1.86mr
系统视场		68° ×54°	41° ×31°
工作温度		-40～+60℃	-40～+60℃
输出制式		PAL	PAL
探测距离	对人	192m	345m
	对车	465m	845m
识别距离	对人	54m	98m
	对车	131m	237m
电源		12V	12V
尺寸		138mm×80mm×85mm	138mm×80mm×85mm
重量		0.76kg(不含磁铁)	0.76kg(不含磁铁)



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CZ-18B-Ⅱ车载红外夜视仪

CZ-18B-Ⅱ车载红外夜视仪，能够使驾驶者在完全黑暗及有烟雾等复杂气象条件下清楚地观察道路及周边环境，保障行人及驾驶安全；可实现军警车辆特殊需求条件下的无灯光驾驶；通过配置云台设备，能对周边环境进行隐蔽观察、搜索和监控。

CZ-18B-II

产品特点

- 采用非制冷红外焦平面探测器，图像分辨率高，使用寿命长、体积小、重量轻、功耗低、性价比高、使用维护简便。
- 有效观察距离是车前大灯视距的三倍，观察视野是车灯角度的四倍。
- 在烟雾情况下，观察距离可达正常视距的7-20倍。
- 可避免夜间会车时，强光照射引起的暂时性视盲、眩目所导致的危险。
- 被动监视，观察隐蔽，识别伪装能力强,也能进行全天候观察。
- 采取"三防"措施，保证产品在恶劣环境中可靠工作。

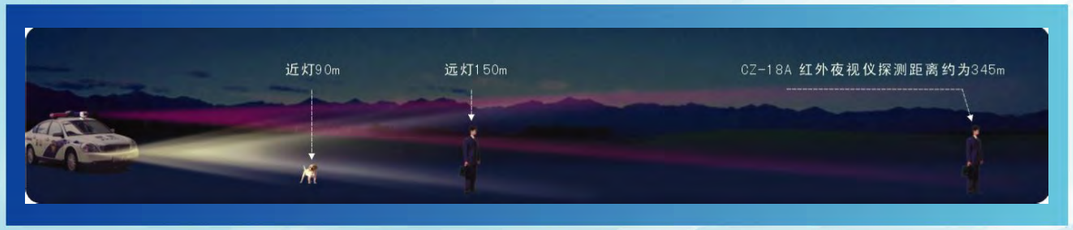
可见光与红外对比图

产品应用

- 安装灵活，可根据需要采用嵌入式固定安装或顶置式便携安装方式。
- 显控装置可采用车载液晶显示屏或隐蔽性更好的双目镜方式进行观察和控制。
- 有多种镜头可选，加装升降机构和云台，可实现远距离、大范围搜索和观察。

产品性能指标

	CZ-18B-Ⅱ	
系统现场	16.4° ±2° ×12.3° ±2°	
探测距离	对人	450m
	对车	900m
识别距离 识别距离	对人	125m
	对车	250m
可视宽度	距车前方30m处	可视宽度8.6m
	距车前方50m处	可视宽度14.5m
	距车前方100m处	可视宽度29m
	距车前方200m处	可视宽度58m
电源	12V	
尺寸	138mmX80mmX85mm	
重量	0.76kg(不含磁铁)	



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广微积电
Beijing Guang Wei Integrated Circuits,Inc
车载红外夜视仪
客户至上　信誉第一　以人为本　技术创新

广微积电

35um 非制冷红外焦平面探测器

384×288

GWIR 02 01 X1A

NOTHING IS INVISIBLE !

北京广微积电科技有限公司

Beijing GuangWei Integrated Circuits, Inc.

广微积电

传感器材料	VOx
面阵分辨率	384×288
像元中心距	35um
填充系数	70%
响应波段	8～14um
*温度灵敏度	(NETD@1/f，300K，50Hz)
GWIR 02 01 21A	≤80mK
GWIR 02 01 31A	≤60mK
典型热响应时间	7ms
盲元率	<0.1%
典型响应率	4-8mV/K
最大帧频	60Hz
动态范围	≥70dB
输出信号	单通道模拟信号
典型功耗（不包括TEC功耗）	200mW
工作温度范围	-40℃～+60℃
存储温度范围	-55℃～70℃
重量	≤15g

*备注：厂家可以根据用户对性能和成本的要求提供不同级别NETD的探测器，产品型号GWIR 0201 X1A中的“X”代表了该探测器的NETD水平。

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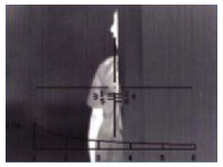
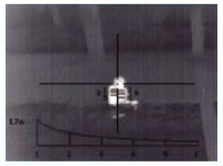
HWQM2×65/T 红外枪用瞄准镜

HWQM2×65/T红外枪用瞄准镜主要与红外头盔热像仪配合使用。可在夜间完全黑暗无光和恶劣气象条件下，对目标进行搜索、观察和快速反应射击。可广泛应用于军、警部队和军事作战、反恐等领域。

HWQM2×65/T





产品特点

- 与头盔热像仪配合使用，转动枪械即可看清枪口所指方向的场景，使用灵活方便，可快速反应，先敌射击。可任意角度瞄准，实施拐角射击。
- 不怕强光干扰。
- 不受枪口高温火焰影响，可实现连续瞄准射击。
- 观察距离远。烟、雾、尘埃环境下的探测距离是可见光产品的7～20倍。
- 产品具有黑/白热（黑热：热辐射目标为黑色，无热辐射为白色。白热：热辐射目标为白色，无热辐射为黑色），增益调节(对比度调节)，电量显示等功能。

产品应用

- 配有数字接口可与数码产品对接，通过数字化单兵系统可进行实时图像传输，实现远程指挥。
- 物镜焦距可调，适用于观察远近不同目标。
- 预存有多种电子十字分划瞄准线，用户可根据不同枪种和射击距离通过菜单进行快速装定。
- 应用范围广，选择不同锁紧机构，可装配国内外军、警多种制式枪械（步枪、狙击枪、转弯枪、高射机枪、班用机枪等）使用。

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红外枪用瞄准镜与微光瞄准镜、近红外瞄准镜的性能比较

产品类型	红外枪用瞄准镜(非制冷探测器)	微光瞄准镜	近红外瞄准镜
探测距离	远	较远	较近
是否需要光源	不需要	需微弱光源	自身光源
能否识别伪装	能	不能	不能
隐蔽性	较好	较好	不好
穿透烟、雾、尘埃能力	较好	不好	不好
强光照射	能承受	不能	受影响
环境温度区分	能	不能	不能
寿命	长	较短	较长

产品性能指标

工作波段	8～14μm
探测器	非制冷红外探测器
像元尺寸	35μm
物镜	65mm F1
视场	11.8°×8.85°
视距	对1.7m直立运动单兵： 识别距离：　300m 发现距离：　600m 对2.3m×2.3m运动中坦克： 识别距离：　600m 发现距离：　1000m
视放大率	2倍
视频输出制式	PAL
环境适应性	国军标
外形尺寸	205mm×117mm×74mm(含眼罩)
分划板	电子分划板
工作电压	8V±1V(欠压报警)
可持续供电时间	>3h
温度分辨率	≤0.1℃
调焦范围	5m～无穷远
调焦方式	手动

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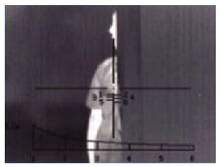
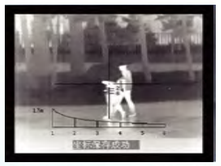
HWQM2.5×50红外枪用瞄准镜

160型红外枪用瞄准具主要用于各型轻武器（步枪、自动步枪、冲锋枪等）夜间瞄准射击。也可以用手持夜间侦察，在完全黑暗及有烟雾等复杂气象条件下清楚地观察发现目标。





产品特点

- 产品适应性强，物镜焦距可调，便于观察远近不同目标。目镜适度可调，适用于不同视力的人；
- 采用电子分划，分划清晰便于调整；
- 在完全无光的条件下，也能清晰地发现目标，并具有一定的识别伪装的能力。
- 产品具有黑热/白热显示功能（便于快捷准确识别目标）；
- 产品具有较好的穿透烟、雾能力（在有烟、雾的同等能见度气象条件下，可视距离是微光夜视仪的7-20倍）；
- 产品不怕强光干扰，可全天候使用。

产品应用

- 配有数字接口可与数码产品对接，通过数字化单兵系统可进行实时图像传输，实现远程指挥。
- 物镜焦距可调，适用于观察远近不同目标。目镜视度可调，适用于不同视力的使用者。
- 预存有多种电子十字分划瞄准线，用户可根据不同枪种和射击距离通过菜单进行快速装定。
- 应用范围广，选择不同锁紧机构，可装配国内外军、警多种制式枪械（步枪、狙击枪、转弯枪、高射机枪、班用机枪等）使用。

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红外枪用瞄准镜与微光瞄准镜、近红外瞄准镜的性能比较

产品类型	红外枪用瞄准镜(非制冷探测器)	微光瞄准镜	近红外瞄准镜
探测距离	远	较远	较近
是否需要光源	不需要	需微弱光源	自身光源
能否识别伪装	能	不能	不能
隐蔽性	较好	较好	不好
穿透烟、雾、尘埃能力	较好	不好	不好
强光照射	能承受	不能	受影响
环境温度区分	能	不能	不能
寿命	长	较短	较长

产品性能指标

光学性能	视放大率	2.5×
	物镜焦距	50mm
	视场角	8°×6°
	分划板	电子分划板
电器性能	探测器组件	非制冷焦平面
	工作电压	8V±1V
	可持续供电时间	>4h
	温度分辨率	≤0.1℃
机构性能	调焦范围	5m～无穷远
	调焦方式	手动
物理性能	重量	1.25kg （含电池）
环境温度	工作温度	(-40～+50)℃
	储存温度	(-43～+55)℃
最小探测距离 对1.7m直立运动单兵 对正截面2.3m×2.3m的装甲车	发现距离	200m
	识别距离	100m
	发现距离	600m
	识别距离	300m

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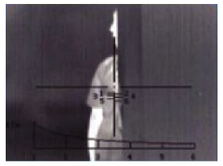
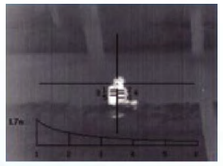
HWQM3.5×75红外枪用瞄准镜

HWQM3.5×75红外枪用瞄准镜可在夜间完全黑暗无光和恶劣气象条件下，对目标进行搜索、观察和精确射击。可广泛应用于军、警部队和军事作战、反恐等领域。

HWQM3.5×75





产品特点

- 可手持作为单目红外望远镜使用。
- 不怕强光干扰。
- 不受枪口高温火焰影响，可实现连续瞄准射击。
- 观察距离远。烟、雾、尘埃环境下的探测距离是可见光产品的7～20倍。
- 产品具有黑/白热（黑热：热辐射目标为黑色，无热辐射为白色。白热：热辐射目标为白色，无热辐射为黑色），增益调节(对比度调节)，电量显示等功能。

产品应用

- 配有数字接口可与数码产品对接，通过数字化单兵系统可进行实时图像传输，实现远程指挥。
- 物镜焦距可调，适用于观察远近不同目标。目镜视度可调，适用于不同视力的使用者。
- 预存有多种电子十字分划瞄准线，用户可根据不同枪种和射击距离通过菜单进行快速装定。
- 应用范围广，选择不同锁紧机构，可装配国内外军、警多种制式枪械（步枪、狙击枪、转弯枪、高射机枪、班用机枪等）使用。

广微积电
Beijing Guang Wei Integrated Circuits Inc
客户至上　信誉第一　以人为本　技术创新

红外枪用瞄准镜与微光瞄准镜、近红外瞄准镜的性能比较

产品类型	红外枪用瞄准镜(非制冷探测器)	微光瞄准镜	近红外瞄准镜
探测距离	远	较远	较近
是否需要光源	不需要	需微弱光源	自身光源
能否识别伪装	能	不能	不能
隐蔽性	较好	较好	不好
穿透烟、雾、尘埃能力	较好	不好	不好
强光照射	能承受	不能	受影响
环境温度区分	能	不能	不能
寿命	长	较短	较长

产品性能指标

工作波段	8～14μm
探测器	非制冷红外探测器
像元尺寸	35μm
物镜	75mm F1
视场	10.24°　×7.69°
视距	对1.7m直立运动单兵： 识别距离：　400m 发现距离：　700m 对2.3m×2.3m运动中坦克： 识别距离：　700m 发现距离：　1200m
视放大率	3.5倍
视频输出制式	PAL
环境适应性	国军标
重量	1.4kg(不含电池)
外形尺寸	269mm×117mm×74mm(含眼罩)
工作电压	8V±1V(欠压报警)
可持续供电时间	>3h
温度分辨率	≤0.1℃
视度范围	-5～+3
调焦范围	5m～无穷远
调焦方式	手动

北京广微积电科技有限公司
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联系电话：010-65630588
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邮　　编：100022

HWSW4.5×100、WSW3.5×75红外双目望远镜

HWS W4.5×100、HWS W3.5×75红外双目望远镜可在恶劣的环境下进行夜间（可全天候使用）观察、搜索、跟踪、识别伪装目标(如人员、车辆等)。可广泛应用于军、警部队和军事作战、反恐等领域。还可用于森林防火、海上搜救、输电线路巡查等民用领域。

产品特点

- 产品可在完全黑暗无光的环境下工作。
- 不怕强光干扰。
- 观察距离远。烟、雾、尘埃环境下的探测距离是可见光产品的7～20倍。
- 产品具有黑/白热(黑热：热辐射目标为黑色，无热辐射为白色。白热：热辐射目标为白色，无热辐射为黑色)，增益调节(对比度调节)，电量显示等功能。

产品应用

- 配有数字接口可与数码产品对接，通过数字化单兵系统可进行实时图像传输，实现远程指挥。
- 产品物镜焦距可调，适用于观察远近不同目标。
- 产品目镜视度可调，适用于不同视力的使用者。

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Beijing Guang Wei Integrated Circuits,Inc
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红外双目望远镜与微光望远镜、近红外望远镜的性能比较

产品类型	红外枪用望远镜(非制冷探测器)	微光望远镜	近红外望远镜
探测距离	远	较远	较近
是否需要光源	不需要	需微弱光源	自身光源
能否识别伪装	能	不能	不能
隐蔽性	较好	较好	不好
穿透烟、雾、尘埃能力	较好	不好	不好
强光照射	能承受	不能	受影响
环境温度区分	能	不能	不能
寿命	长	较短	较长

产品性能指标

产品性能	(HWSW4.5×100)	(WSW3.5×75)
探测器	非制冷红外探测器	非制冷红外探测器
像元尺寸	35μm	35μm
物镜	100mm F1	75mm F1
视场	7.69°×5.77°	10.24°×7.69°
视距	对1.7m单兵： 识别距离：500m 发现距离：1000m 对2.3m×2.3m运动中坦克： 识别距离：750m 发现距离：1500m	对1.7m单兵： 识别距离：400m 发现距离：700m 对2.3m×2.3m运动中坦克： 识别距离：700m 发现距离：1200m
视放大率	4.5倍	3.5倍
视频输出制式	PAL	PAL
环境适应性	国军标	国军标
重量	1.7kg(不含电池)	1.6kg(不含电池)
外形尺寸	275mm×168mm×72mm(含眼罩)	251mm×168mm×72mm(含眼罩)
工作电压	8V±1V(欠压报警)	8V±1V(欠压报警)
可持续供电时间	>4h	>4h
温度分辨率	≤0.1℃	≤0.1℃
视度范围	-5～+3	-5～+3
调焦范围	5m～无穷远	5m～无穷远
调焦方式	手动	手动

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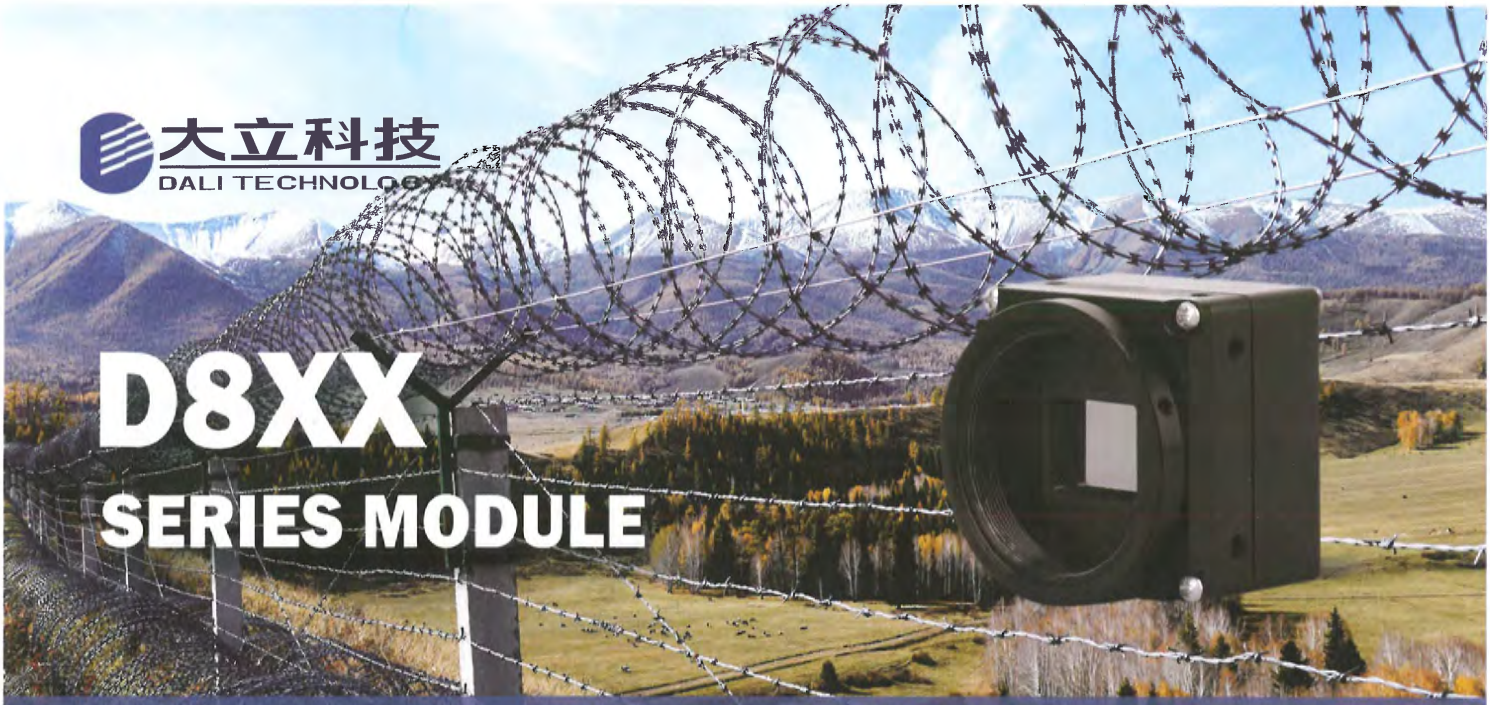
Exhibit B – Part 2

大立科技
DALI TECHNOLOGY



D8XX SERIES MODULE

OEM thermal imaging cores for system integration

Features

- DALI self-innovation detector ,cost effective
- Small & light with multiplle interface for easy integration
- High resolution, sharp image
- Low consumption
- Color palettes as option for better observation
- Perfect operational temperature adaptability: -40 C ~ +60 C


Series Module


DALI detector

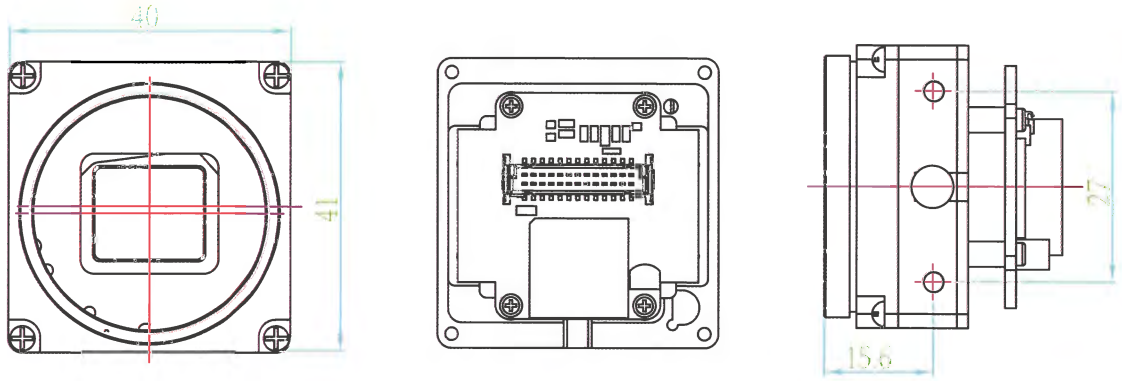
Application

Specifications

Items		D880A	D880B	D840
Detector characteristics	Detector type	Uncooled FPA microbolometer		
	Array size	384×288		640×480
	Pixel	25um	17um	17um
	Spectral range	8~14um		
	Temp control	TEC		
	NETD	≤60mK(f/1,300K,25-50Hz)		
	Thermal time constant	≤5ms		
Image characteristics	Frame rate	50Hz		
	Display resolution	768×576		640×480
	Analog video output	PAL		
	Digital Video	14-bit parallel CMOS/8-bit BT.656		
	Gain/Brightness adjustment	Manual brightness/gain ; auto brightness/manual gain; auto brightness/gain		
	Digital zoom	2X、3X、4X		
	Calibration	Manual and Auto		
System characteristics	Communication Protocol	DALI/PELCO-D protocol		
	Image Filter	YES, Digital filter		
	Polarity inversion	White/black hot mode		
	Colour	12 color palettes changeable		
Power supply	External power	DC 5V±0.2V		
	Power consumption	≤2W(normal atmospheric temp)		
Electrical interface	Power interface	YES		
	Analog video output	YES		
	Digital Video output (optional)	YES		
	Serial port	TTL 3.3V		
Environment	Operation temperature	-15℃~ +50℃(Can expanded to -40℃~ +60℃)		
	Storage temperature	-40℃~ +70℃		
	Humidity	5~95%, Non condensing		
physical characteristics	Size (mm)	40× 41× 35mm		
	Weight	≤76g(including housing、shutter)		
	Lens mount interface	M34×0.75 ;screw thread		
	Mechanical interface	2×M3(four sides); screw hole		
	Electrical connector	26 pins connector(including cable)		

▲ The information contained in this document is subject to change without notice

Dimensions



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GUIDE

Thermcore iM II Series

Ultra-low Power Consumption Mini-size TI Module

The new Thermcore iM-II is the latest product available from the production of Guide Infrared. It is designed as one of the smallest OEM cores available in the market, with the lowest power consumption and self-adapting calibration with no shutter. With its advance image processing algorithm, the iM-II is producing sharp and crisp stable images. It is one of the best and highest quality pictures, based on 50Hz full frame video speed and 384×288 resolution for more image detail.

Features and Benefits

- **Small size, light weight**

  40×40×20.6mm without lens;
  High-integrative, only two electronic boards

- **Extremely low power consumption**

  Intelligent power management, total power consumption is less than 1.2W

- **Self-adapting image processing algorithm**

  Shutter-less, self-adapting calibration of picture according to specific scene, ensure crisp, clear imaging without noise

- **Refresh rate**

  Full 50Hz real time video speed

- **FPA**

  384×244, 30% more pixels for more detailed quality images then 320×240 alternative technology

- **Standard lens interface, three standard lenses optional**

  Three standard lenses: 9.6mm, 14.8mm, 25mm and 50mm. More lens choices are available

- **OEM Support Services**

  We provide full OEM technical support services;
  Firmware design, some customized cable design, SDK etc

Applications

- System integration
- Security and surveillance
- R & D
- UAV / UGV

Specifications

Edition_GD130805

Infrared Detector				
Detector type	Uncooled Focal Plain Array (UFPA)			
Detector pixel	384×288			
Pixel size	25μm			
Spectral range	8μm~14μm			
Lens				
Focus	9.6mm	14.8mm	25mm	50mm
F#	1.0	0.95	1.0	1.0
Field of View (FOV)	53° ×41°	35.5° ×27°	21.7° ×16.4°	10.97° ×8.24°
Focus mode	fixed	fixed	Manual	Manual
Image				
Video output	Analogue video: PAL (50HZ)/NTSC(60HZ)，Digital video: TTL video			
Image enhancement	Digital image enhancement DDE			
Calibration compensation	Self-adaption calibration without shutter			
Brightness/Contrast	Auto			
Polarity	White/black			
Power Supply				
Voltage	3~5VDC，can be powered by single li-ion battery			
Power consumption	≤1.2W@25℃			
Environmental Adaptability				
Operating temperature range	-40℃ ~+60℃			
Interface				
Electrical interface	Power, analogue video, network interface, protocol RS232			
Physical Characteristics				
Size	40×40×20.6mm(Without lens) 40×40×31.5mm(Without lens,with lens mount)			

WUHAN GUIDE INFRARED CO.,LTD
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E：overseas@guide-infrared.com

EUNIR SYSTEMS NV
Kapeldreef 60,3001 Heverlee, Belgium
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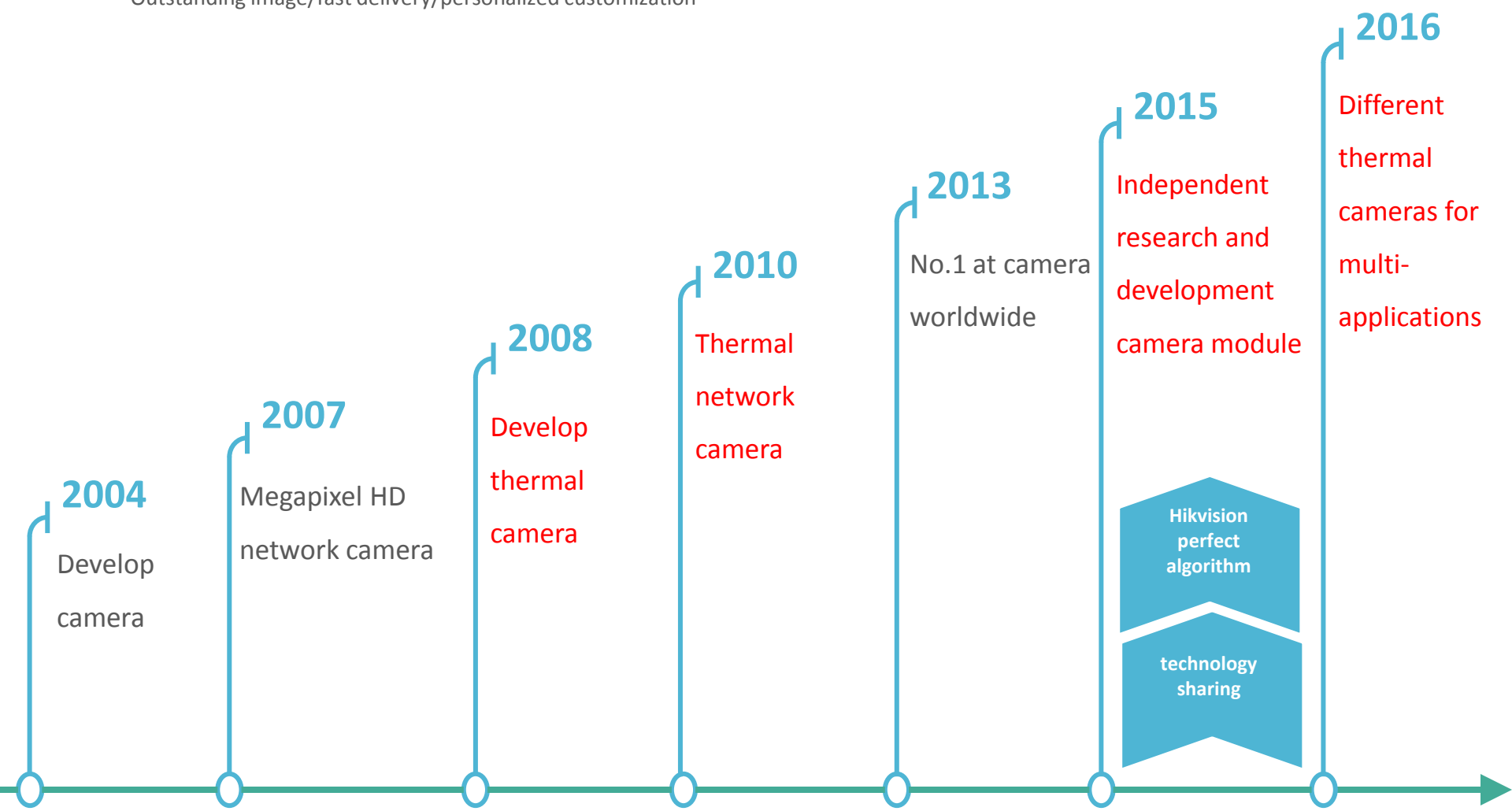
GUIDE

HIKVISION
HIKVISIONVIETNAM.VN VIETNAM

2016 THERMAL CAMERA

HIKVISION thermal camera development history

- Independent research and development camera module
- Outstanding image/fast delivery/personalized customization




10-16-2014 星期四 18:27:33
P203:T25
可见光


10-16-2014 星期四 18:27:32
热成像

- Principle of Thermal Radiation
- Core Competence
- Products & Application Scenarios

Part 1

Principle of Thermal Radiation

Principle of Thermal Radiation

Infrared & Thermal Radiation

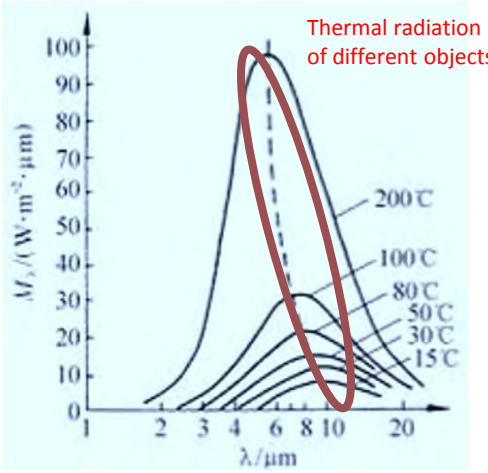
Except the visible light, there is one kind of invisible light we called it infrared ray.

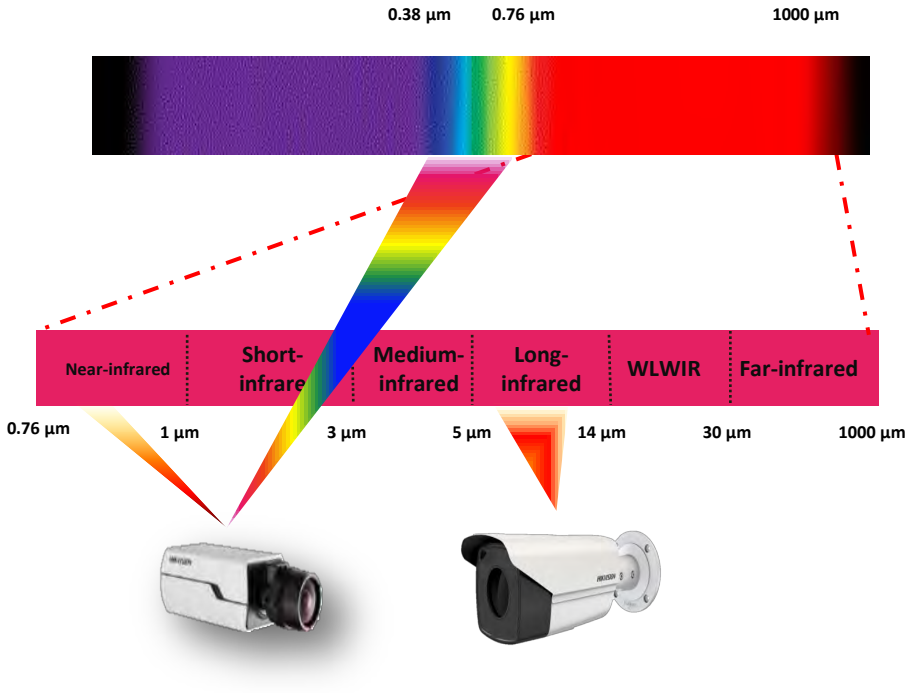
All the objects above absolute zero can radiate electromagnetic wave (infrared) constantly. we called this phenomenon the ‘Thermal Radiation’

Visible light & near-infrared: 0.4-2.5 μm

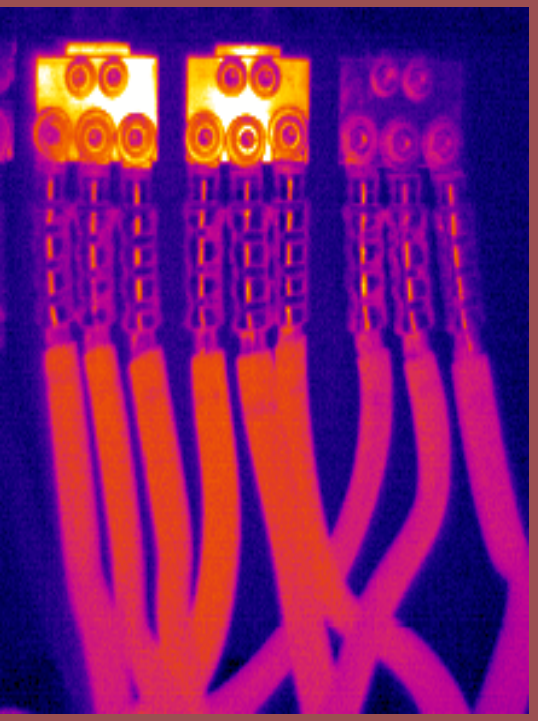
Medium-infrared: 3.5~4 μm

Thermal infrared: 8~14 μm





Principle of Thermal Radiation



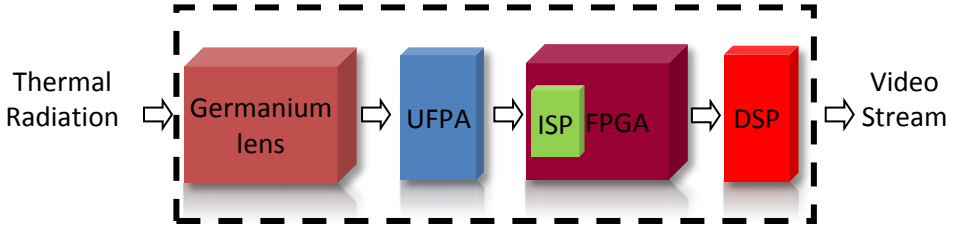
Everything (temperature above absolute zero -273℃) in nature has the thermal radiation

Principle of Thermal Radiation

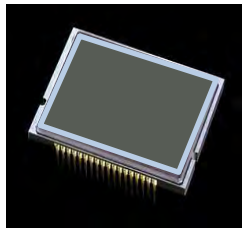
Image-forming Principle

Lens: Germanium lens, reflect visible light and ultraviolet light

UFPA change the thermal radiation to electric signal.



Thermal Camera Image-forming Principle

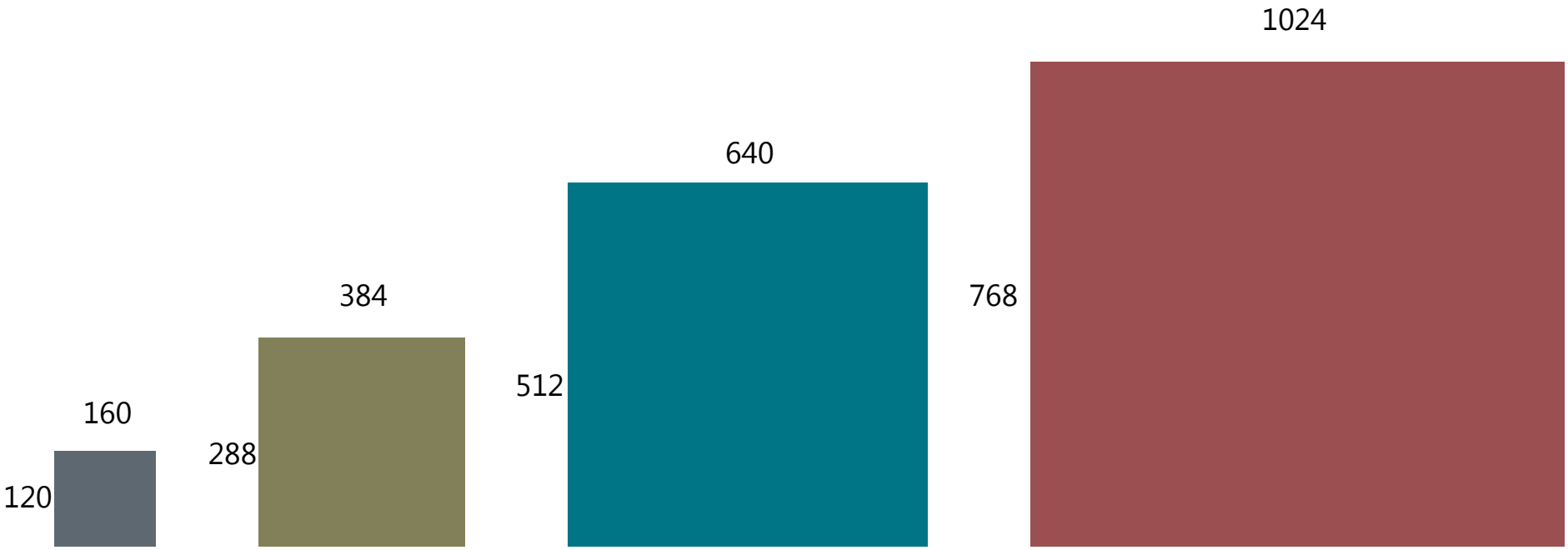


Principle of Thermal Radiation

Image-forming Principle

Sensor:

Resolution is the most important parameter of sensor. Right now, the mainstream of resolution in the market are:
160x120/384x288/640x512/1024x768

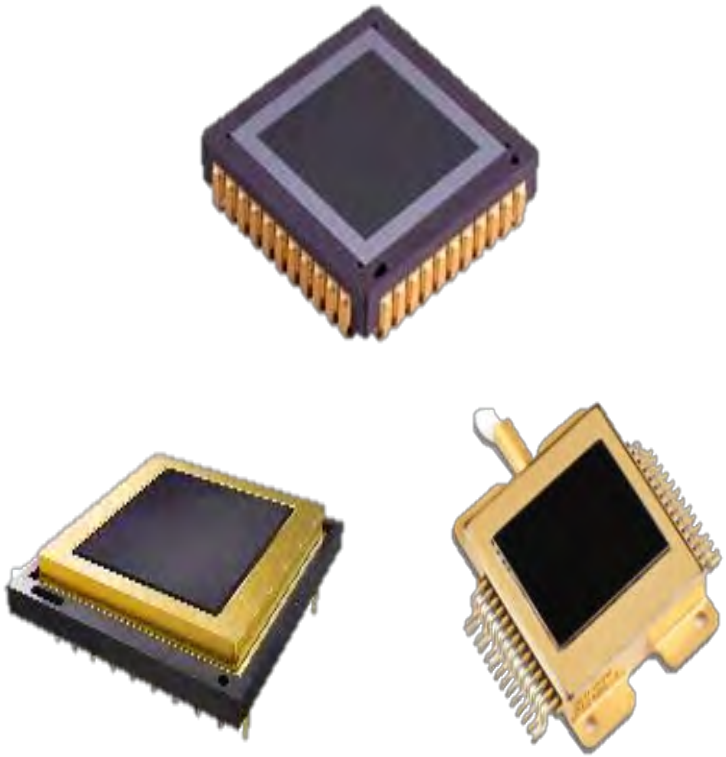


Principle of Thermal Radiation

Image-forming Principle

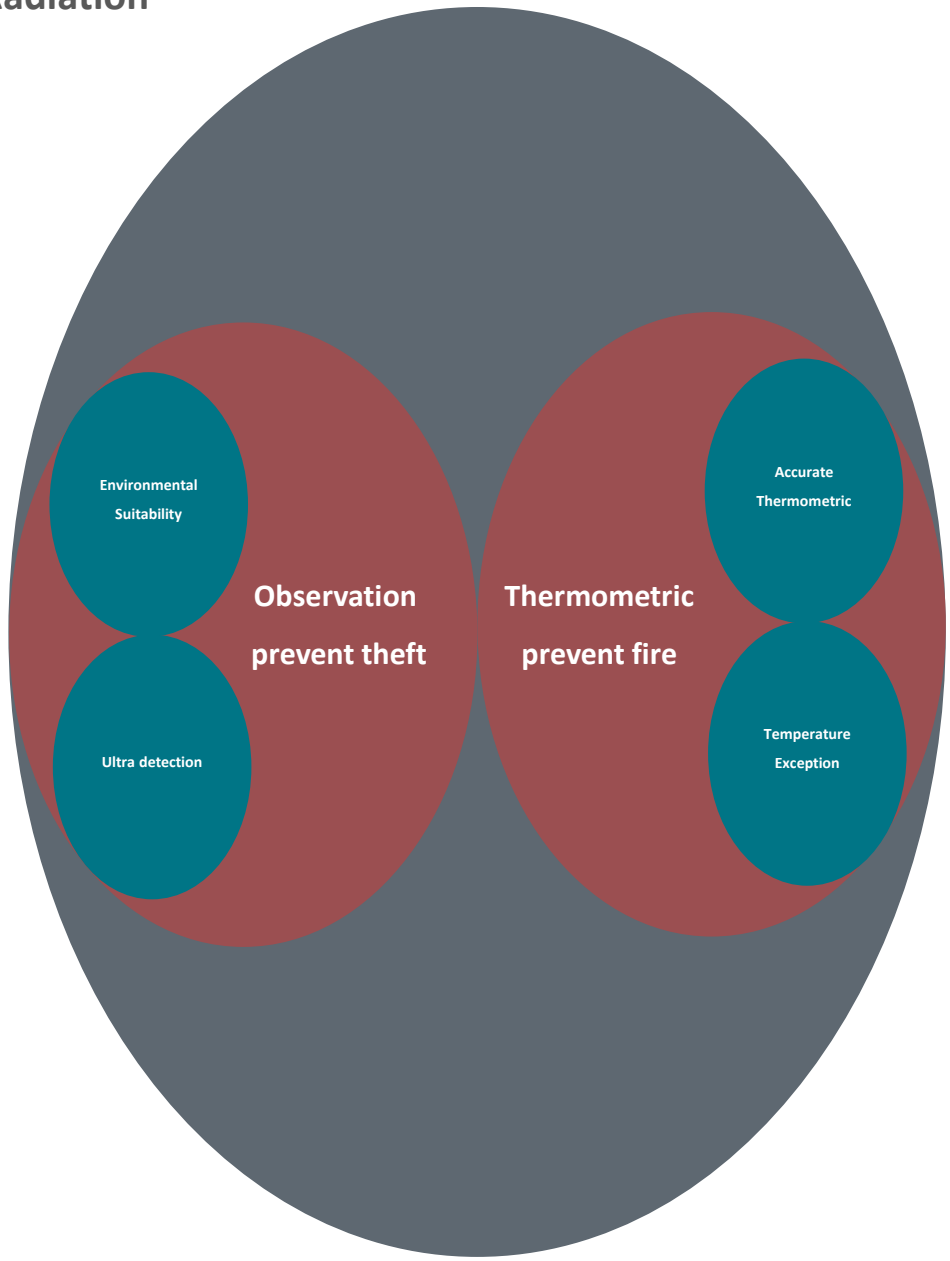
Pixel interval:

Right now, the mainstream of resolution in the market are: 17μm/25μm/30μm/35μm. Small pixel interval means more cost-effective.



Principle of Thermal Radiation

Thermal technical classification



Key features of observation product

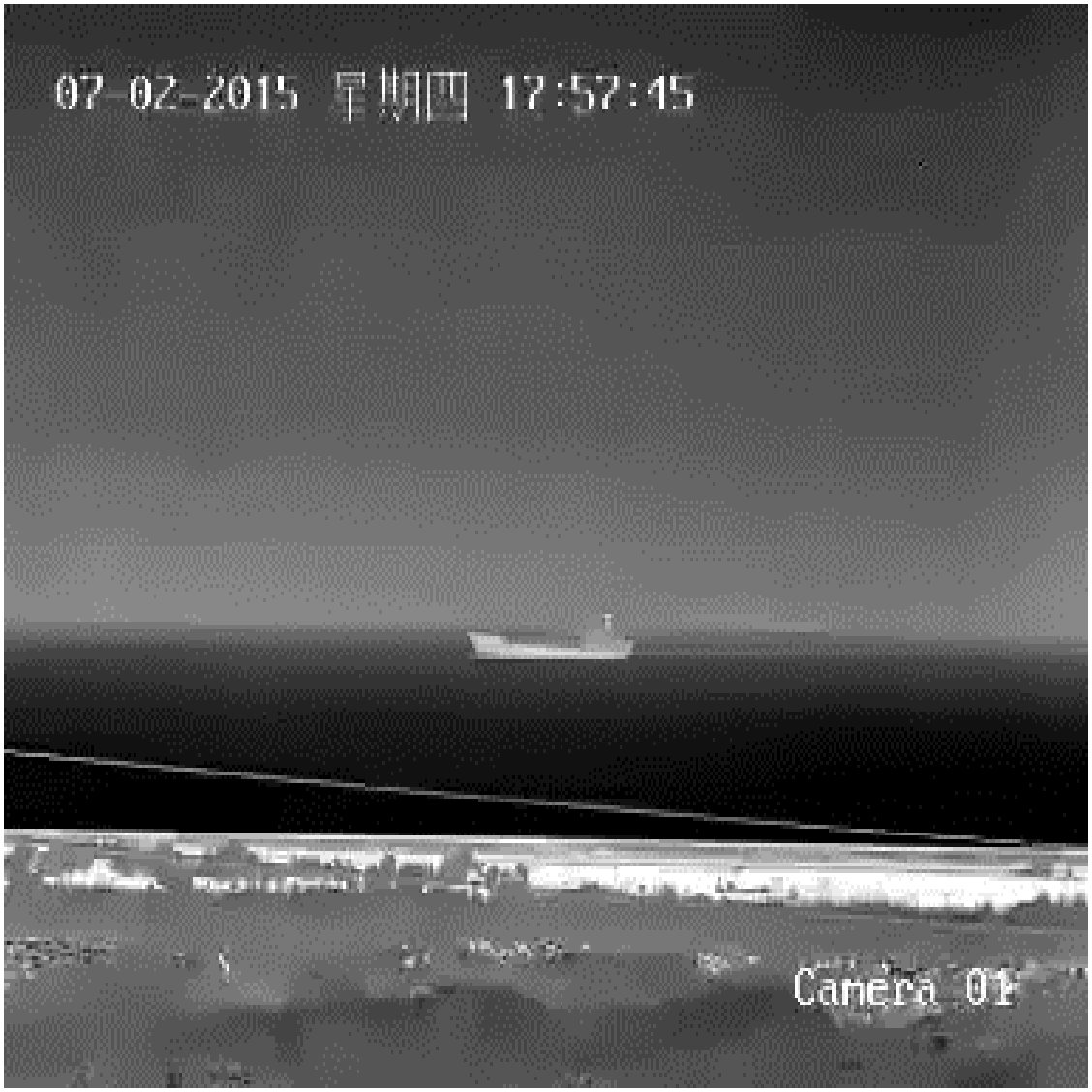
- Environmental Suitability

Suitable for foggy environment.
No supplement light in the night.
Find the hidden objects

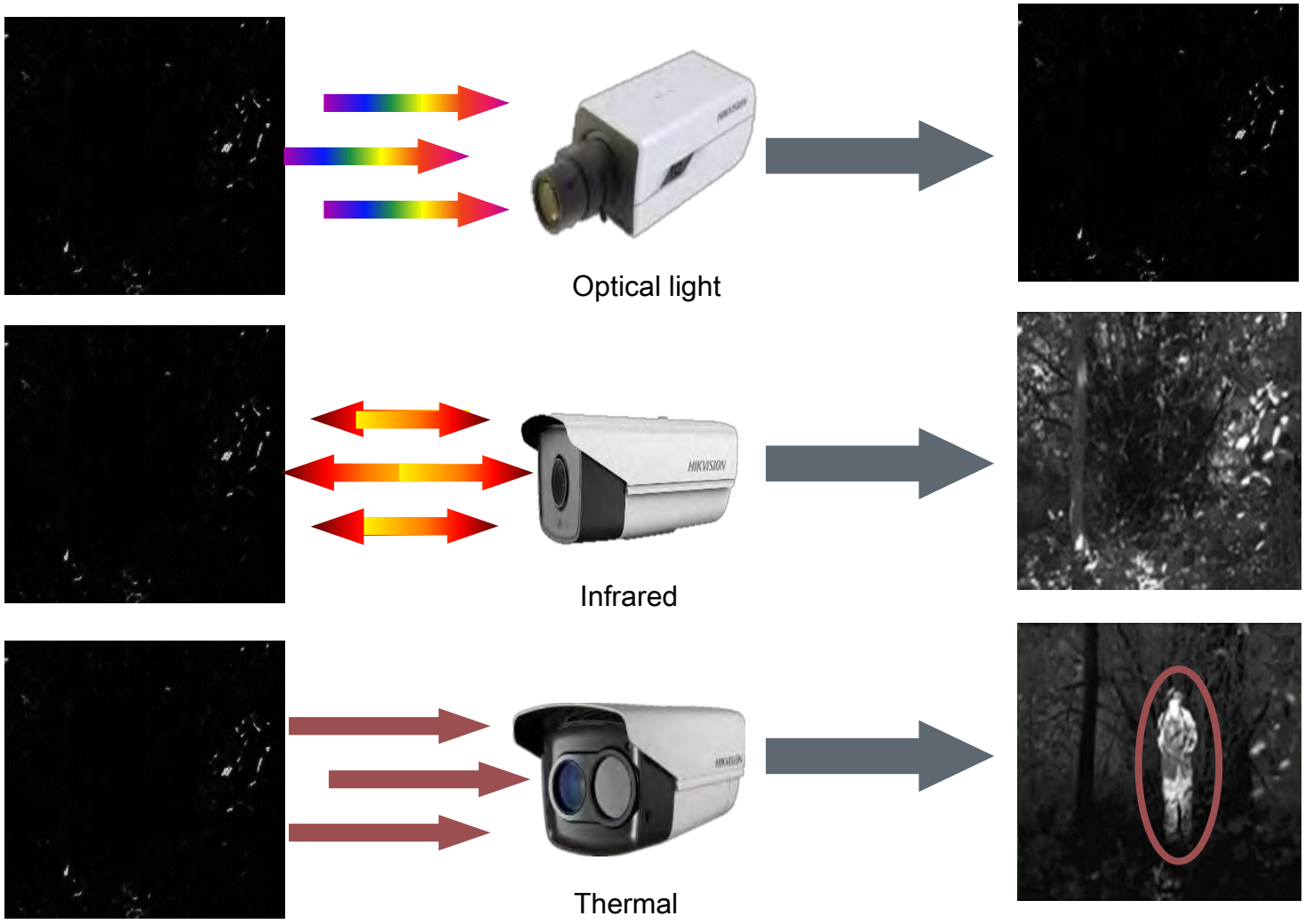
Application of observation product

Suitable for foggy environment.
No supplement light in the night.

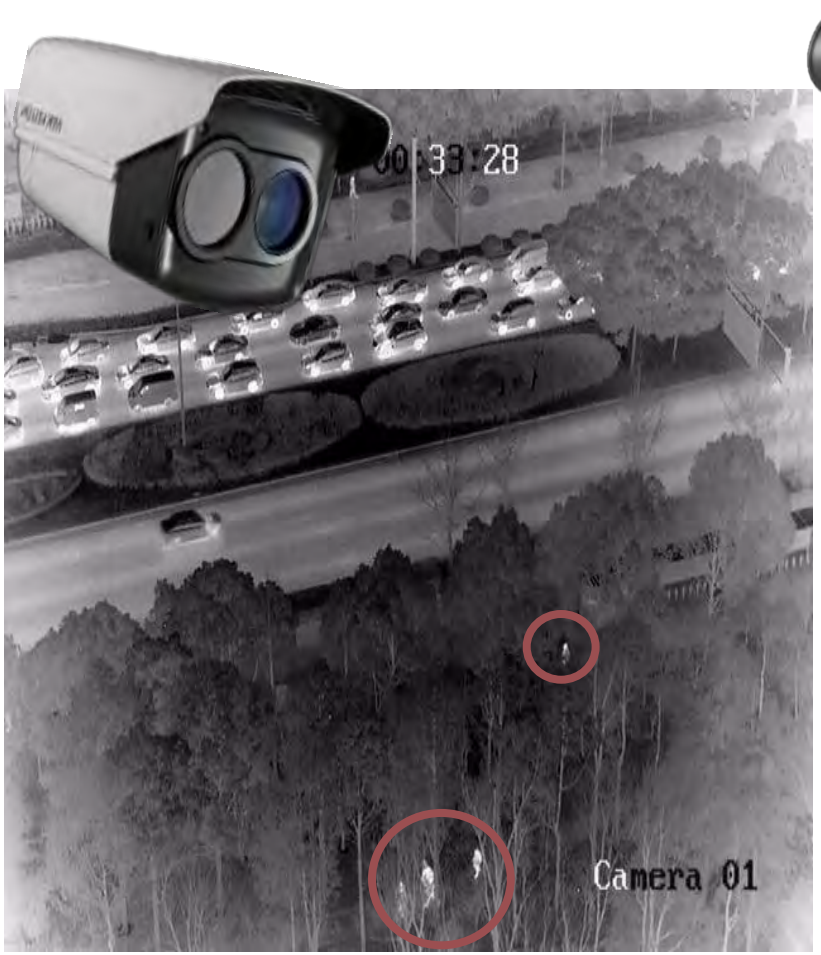
- Seaside
- Border



Key features of observation product



Application of observation product



- Border

- Forest

Key features of observation product

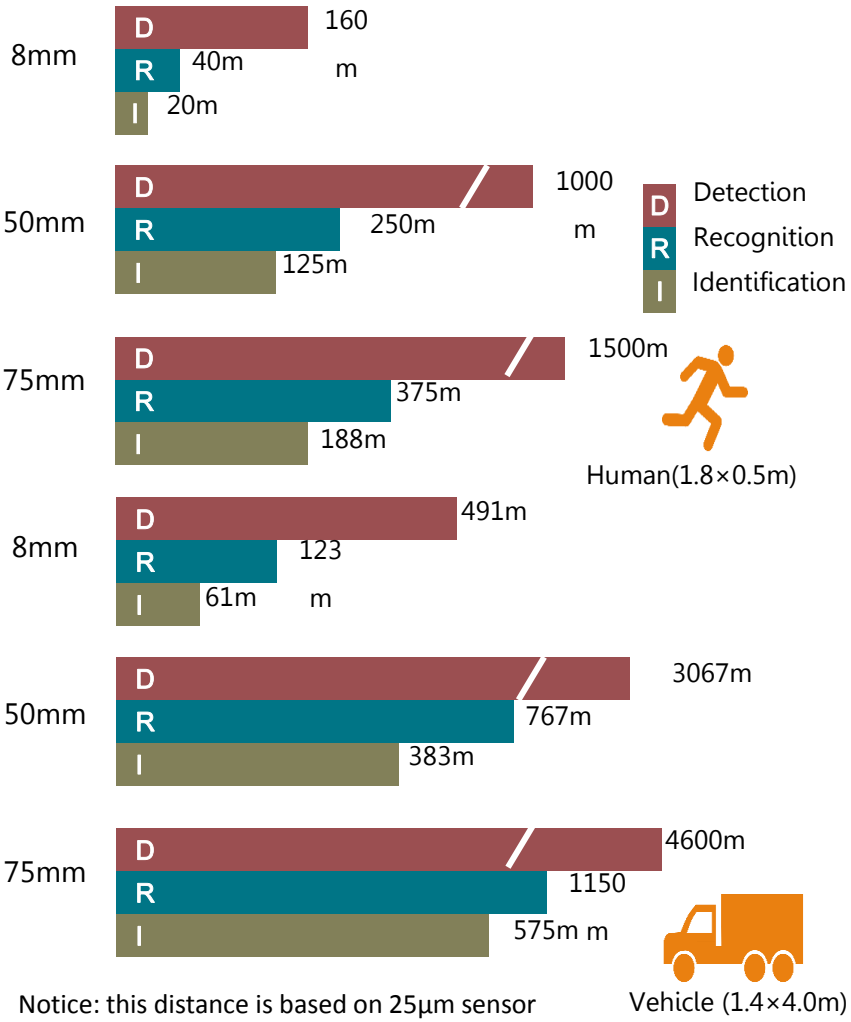
- Passive Detection
- Non-IR & Invisible-IR

Do not need supplement lights. Suitable for dim illumination environment.

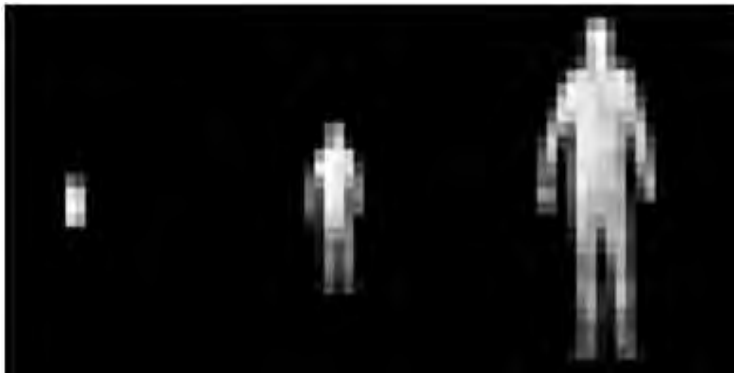
Application of observation product

Military applications

Detection distance



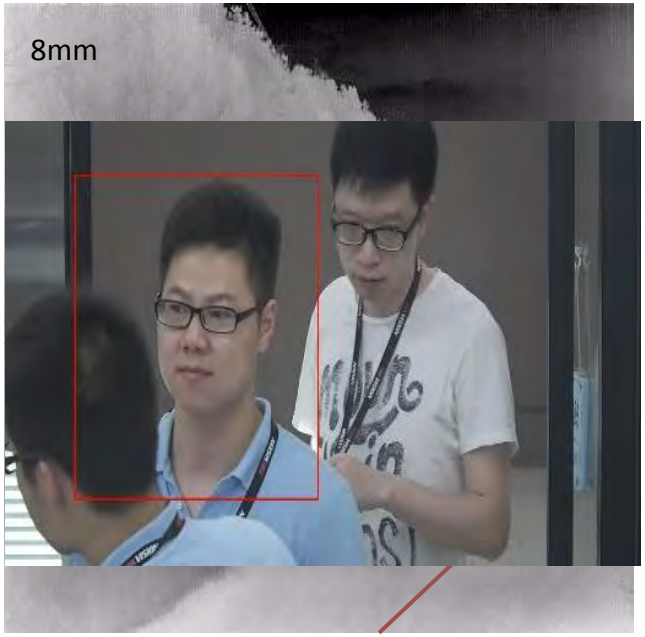
Notice: this distance is based on 25μm sensor



Detection — 1.5 pixels

Recognition — 6 pixels

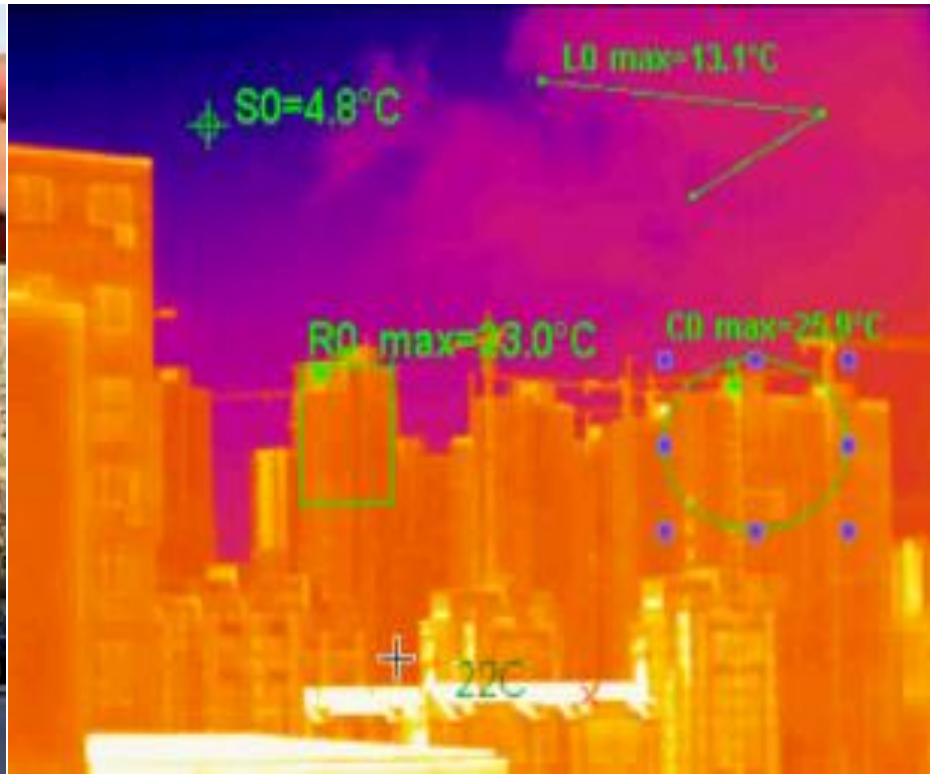
Identification — 12 pixels



Key features of thermometric product

Temperature Exception

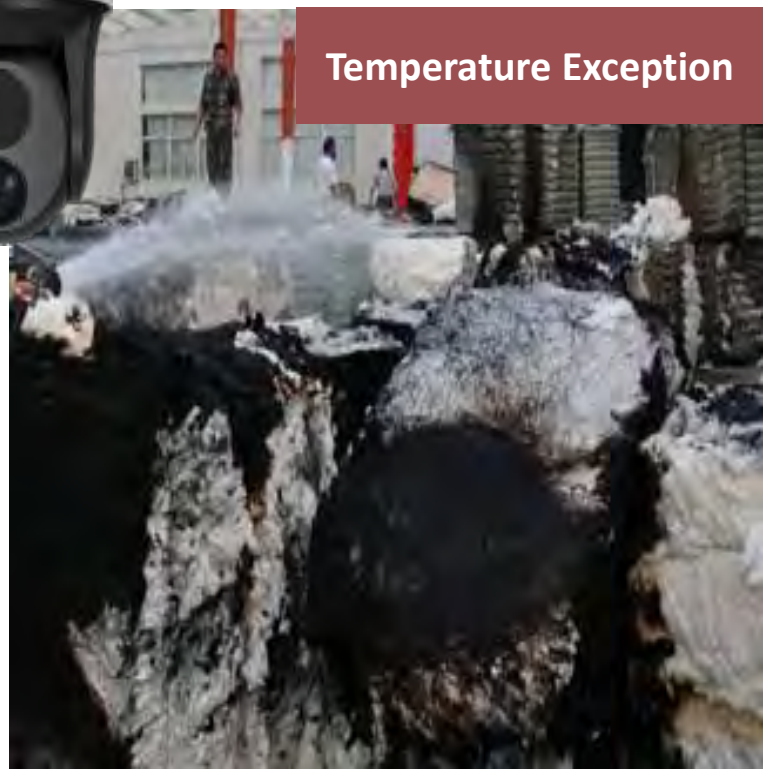
Accuracy: ±8℃



Accurate Thermometric

Accuracy: ±2℃/±2%

Application of rough thermometric product

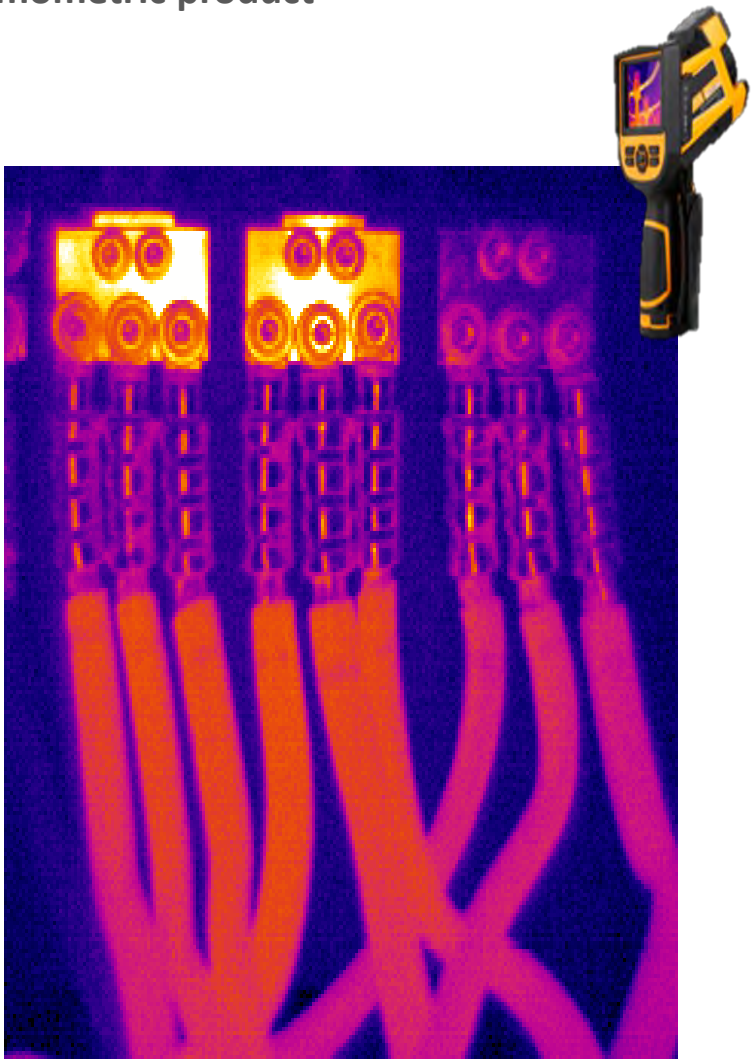


Warehouse

Application of accurate thermometric product

Fire protection(Electric/Petroleum/Petrochemical)

Application of accurate thermometric product



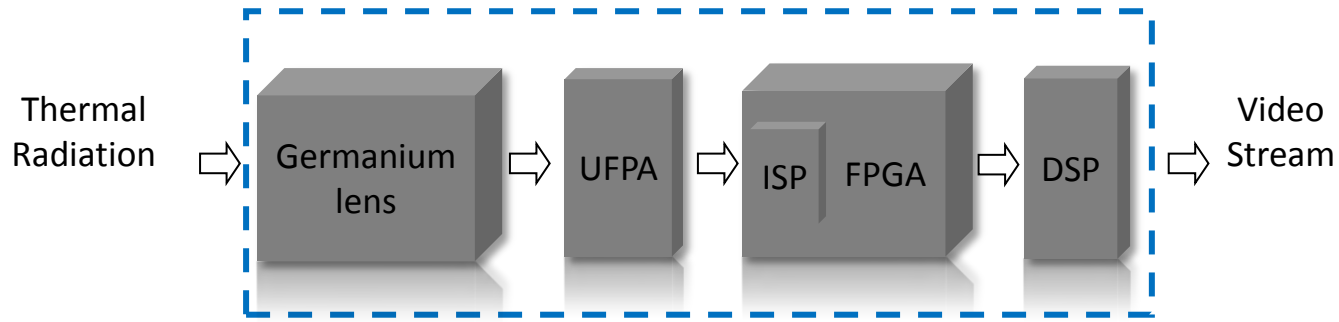
Electric & industry preventive test

Fuse/engine coil/bearing/electric cable

Exhibit B – Part 3

Core Competence

Core Competence



Thermal Camera Image-forming Principle

01. Better image

Independent research and development camera module

02. Better smart functions

Smart analysis

03. Better applications

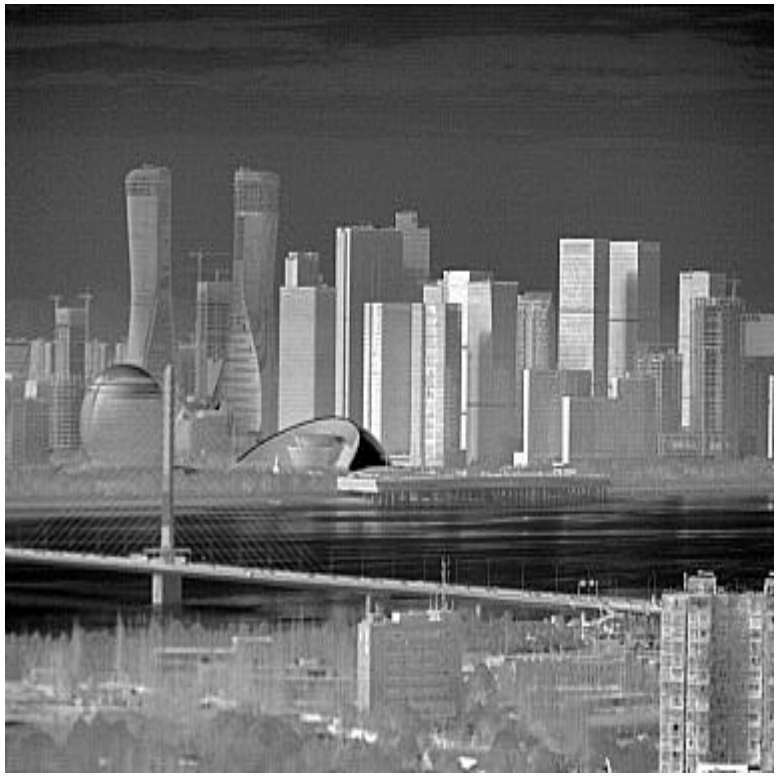
Temperature Exception

(all series products support @ May)

Core Competence

Image

AGC OFF



AGC ON

Core Competence

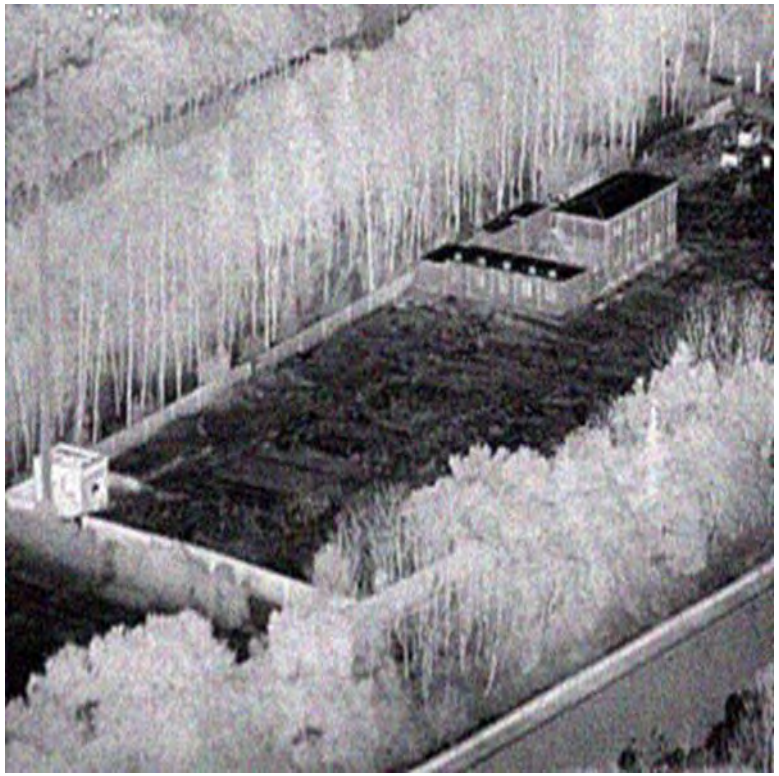
Image

DDE OFF

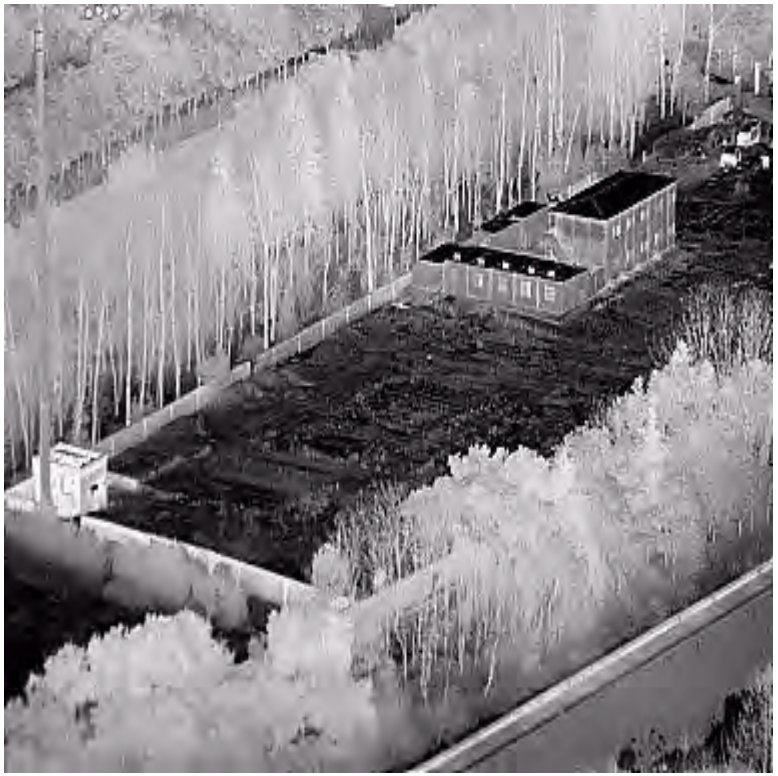
DDE ON

Core Competence

Image



3D DNR OFF



3D DNR ON

Image comparison(HIKVISION vs FLIR)

FLIR

HIK

Smart function

Behaviors analysis + thermal radiation

Products & Application Scenarios

Products & Application Scenarios

Hikvision self camera module

DS-2TD2235D Series

DS-2TD4035 Series

DS-2TD2166 Series
DS-2TD2135 Series

DS-2TD6166 Series
DS-2TD6135 Series

Fire detection

Thermal

Optical

Optical linkage

Thermal

Optical

Thermal & optical correction

Thermal & optical image get the same central point

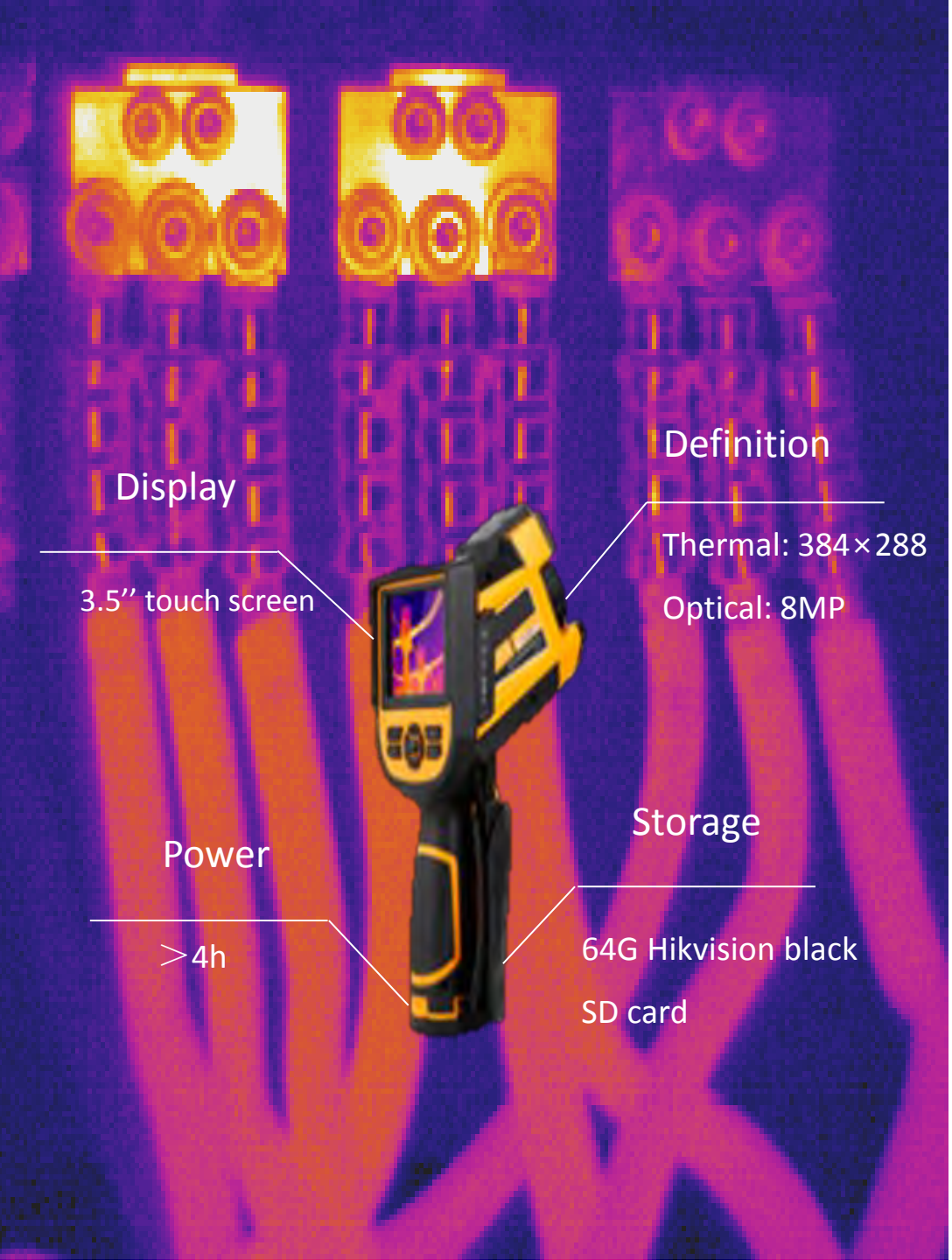
Products & Application Scenarios

Integration

	Live view	Storage	Smart function	VCA function
iVMS-5200（V3.3）	√	√	√	√
NVR（V3.4.0 or above）	√	√	V3.4.7	V3.4.7

Smart function:
Fire detection/audio exception

VCA function:
Line crossing/intrusion detection/region entrance/region exiting



Core Competence

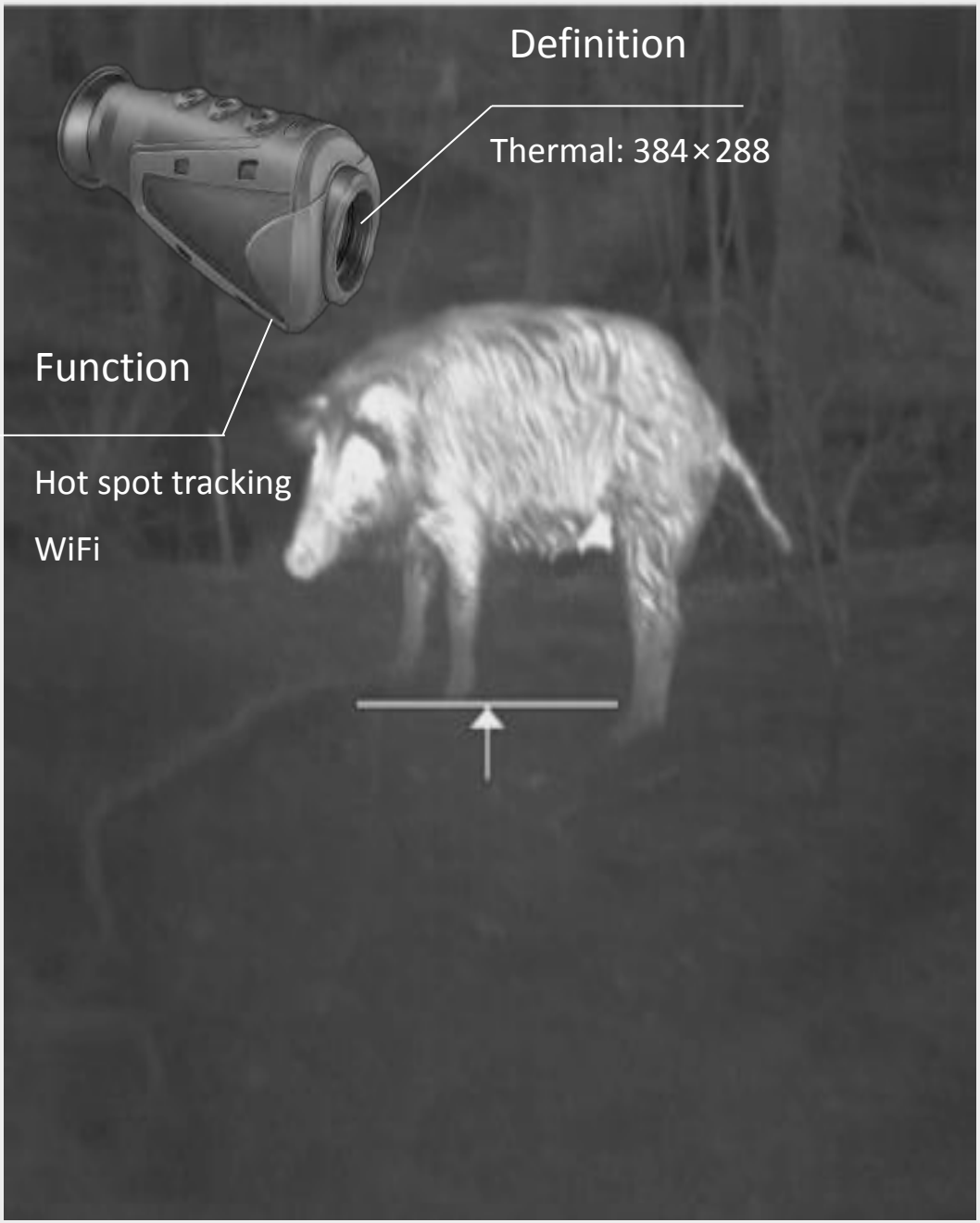
- Image (DDE/3D DNR/AGC)
- Thermal + Optical
- Thermometric & easy to use

Handheld + Thermometric

Application

Electric & industry preventive test

Fuse/engine coil/bearing/electric cable



Core Competence

- Image (DDE/3D DNR/AGC)
- EZVIZ
- Laser positioning/Automatically sleep

Handheld + Observational

Application

Vertical application

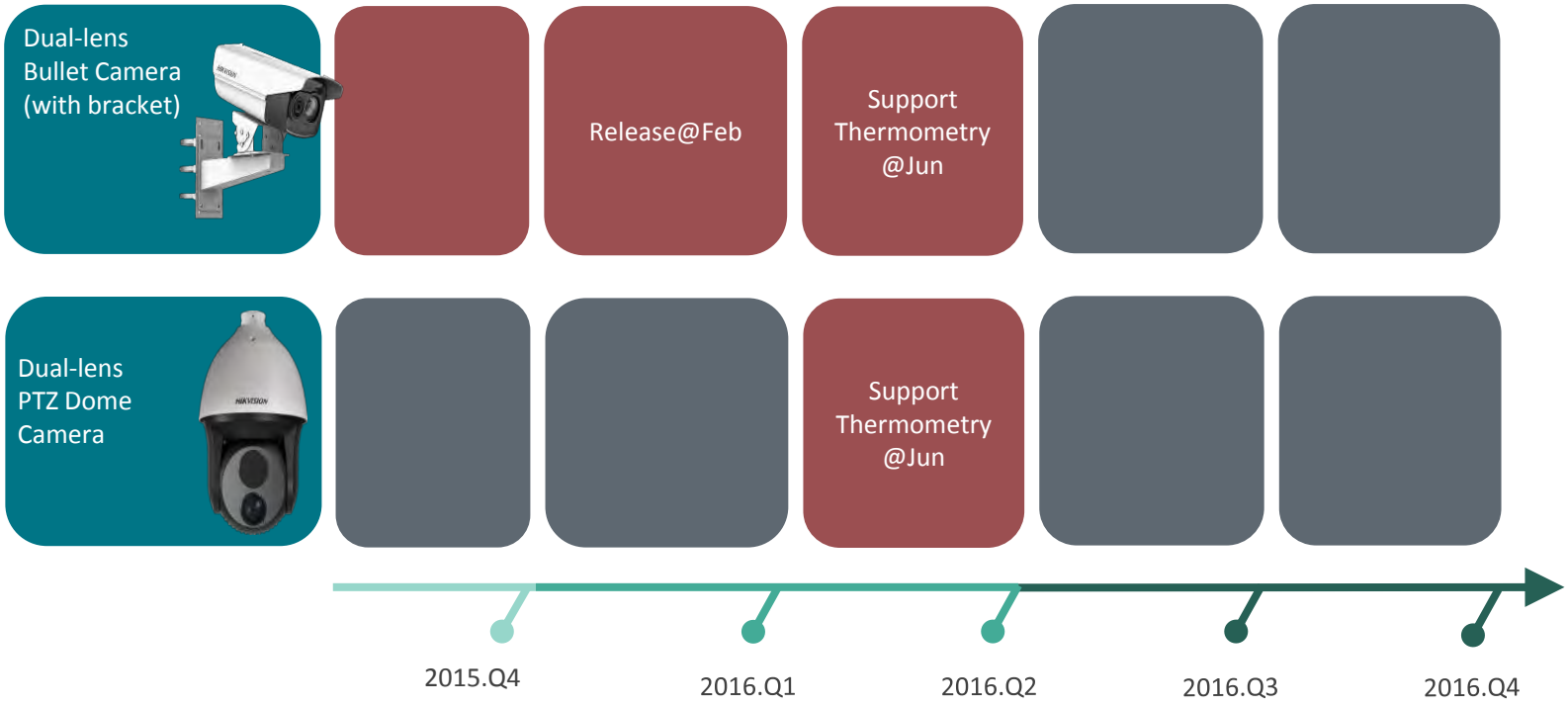
Patrol/rescue/criminal tracking

Consumer field

Hiking/hunting

◦

2016 Roadmap



2016 Roadmap

	2015.Q4	2016.Q1	2016.Q2	2016.Q3	2016.Q4
Camera Module 	384 x 288 25μm released	640 x 512 17μm Sample@Apr	384 x 288 17μm Release@Jun		
Positioning System 		Sample@Apr Release@May (Observational &Thermometric)			
Bullet Camera 			Sample@May Release@Jun	Release@Aug (Thermometric)	
Handheld Thermometric Thermal camera 			Sample@May Release@Jun		
Handheld Observational Thermal Camera 			Sample@May Release@Jun		

HIKVISION VIETNAM
HIKVISIONVIETNAM.VN

Keii

GUANGZHOU KEII ELECTRO OPTICS TECHNOLOGY CO.,LTD.

公司简介及主营产品

广州科易光电技术有限公司

GUANGZHOU KEII ELECTRO OPTICS TECHNOLOGY CO.,LTD.

公司简介 Company Profile

广州科易光电技术有限公司成立于2003年，位于广州市高新技术开发区科学城，是一家专业从事各种红外光电产品及红外系统集成的高新技术企业。

公司自成立以来，一直重点开发围绕红外热成像技术为主的光电产品，在热成像系统的应用研究、相关配套软硬件的开发等方面具有非常丰富的经验。公司的产品开发和设计，着眼于使用户更高效、更安全、更便捷地查找、确认和解决潜在隐患。

科易光电自主研发生产的各型机载红外成像及可见光成像系统，重量更轻、功能更强，处于业内领先地位，可搭载于各种常用直升机及无人机。广泛应用于输电线路巡检、安全隐患及灾害监测、安保监控以及国土测绘等多领域。最新研发的新型红外有机气体检漏设备，可在复杂的生产环境下实时准确地检测出易燃易爆气体泄漏点，为快速定位泄漏点提供了行之有效的方法，特别适用于装置复杂并对泄漏隐患特别敏感的石油化工领域。

无论常规应用还是特殊应用，科易光电均拥有丰富的专业知识和经验，全心投入，结合应用实践中的资源，为用户提供从单机到系统的红外解决方案。同时，我们也可为有红外检测需要的客户提供检测服务，并提交由公司ITC认证工程师出具的专业检测报告。

从中国大陆到全球各国，科易光电的标准化及定制化产品销售持续增长，客户既有政府部门、电力及石化等大型，也有各行各业的专业公司。

公司的目标是引领技术潮流、开拓红外应用、争当全球红外热成像企业中的佼佼者！

荣誉资质 Qualifications And Patents

自2003年成立以来，公司经过不断努力，于2009年最终创立并完善了公司的ISO体系，充分保证了产品质量与品质管理，最大限度地保护了产品使用者的权益，并于2014年顺利通过年审。

凭借厚实的技术背景，公司在2008年被广东省（广东省科学技术厅）正式认定为“高新技术企业”。

2013年，作为一家具有高成长性潜力、技术创新能力强的科技企业，公司被广州市经济技术开发区正式授予“瞪羚企业”的荣誉称号，成为广东省重点培育的红外企业之一。

知识产权方面，凭借敏锐的市场嗅觉及不断创新的产品，公司成立短短十余年，已先后获得包括外观设计专利、实用新型专利、发明专利在内的专利共计89项，另外还拥有计算机软件著作权共计22项。公司掌握所有专利及著作权的核心技术，在为特殊行业提供系统解决方案上奠定了厚实的基础。

高新技术企业证书

广州开发区2013年瞪羚企业荣誉证书

认证证书
ISO9001质量管理体系认证。

认证证书
产品CE认证。

发明专利
红外线热成像图像及可见光图像复合视频实时显控装置。

实用新型专利
基于网络和嵌入式计算机的红外温度监测装置。

外观设计专利
热像仪（KC-800）

Keii科易光电
GUANGZHOU KEII ELECTRO OPTICS TECHNOLOGY CO.,LTD.

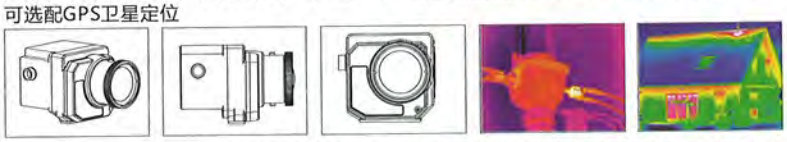
先进红外光电系统制造者

企业主要产品系列 Product Line

苍鹭系列无人机全动态观察型热成像仪

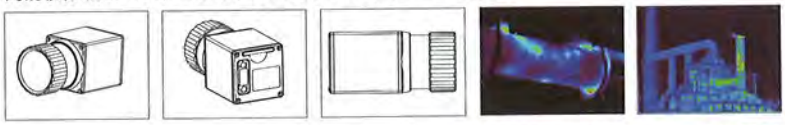
CL-1024

专为轻型无人机设计，应用国产高灵敏度1024x768探测器，重量≤300g，观察型高清红外热像仪，更高像数，更高灵敏度，可选配1080P 高清视频输出 SDI、HDMI、YUV接口，可选配GPS卫星定位



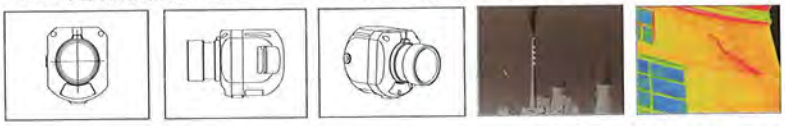
CL-640/320mini

专为轻型无人机设计，重量≤110g,轻小易用，实现消费无人机轻松升级，可选配1080P 高清视频输出 SDI、HDMI、YUV接口,可选配GPS卫星定位



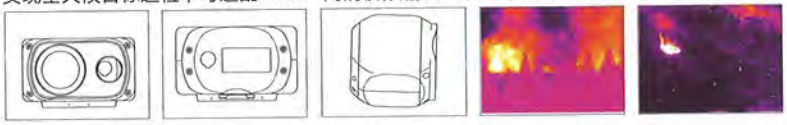
CL-640/320S

专为轻型无人机设计，重量≤210g,轻小易用，实现消费级无人机轻松升级，可选配1080P 高清视频输出 SDI、HDMI、YUV接口，可选配GPS卫星定位



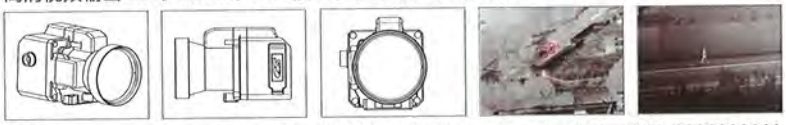
CL2-640

专为轻型无人机设计，高清可见光加加640x480像数热像仪，数据同步记录，同步分析，实现全天候目标巡检，可选配1080P 高清视频输出 SDI、HDMI、YUV接口



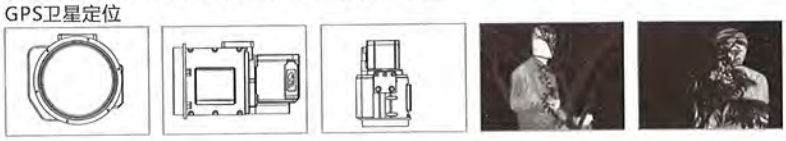
CL-640L（长焦型）

专为轻型无人机设计，重量≤320g,50mm长焦镜头，可远距离发现目标，可选配1080P 高清视频输出 SDI、HDMI、YUV接口，可选配GPS卫星定位



CL-640KZ（双视场切换型）

专为轻型无人机设计，重量≤710g,双视场切换，满足近距离观察，远距离侦查，可轻松识别800m外人体目标，可选配1080P 高清视频输出 SDI、HDMI、YUV接口，可选配GPS卫星定位

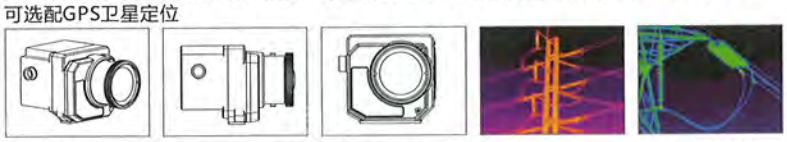


Product Line **企业主要产品系列**

慧龙系列无人机全动态测温型热成像仪

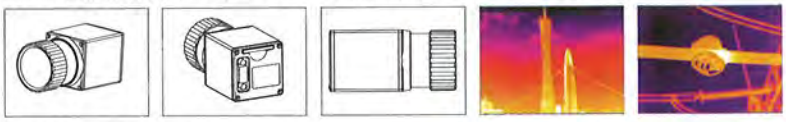
HL-1024

专为轻型无人机设计，应用国产灵敏度,采用1024x768探测器，重量≤300g, 测温型高清红外热像仪，更高像数，更高灵敏度，可选配1080P 高清视频输出 SDI、HDMI、YUV接口，可选配GPS卫星定位



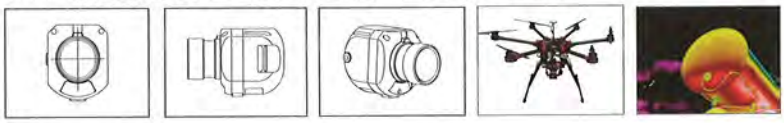
HL-640/320mini

专为轻型无人机设计，重量≤120g,全动态精准测温，16位全画副实图录像，可选配1080P 高清视频输出 SDI、HDMI、YUV接口，可选配GPS卫星定位



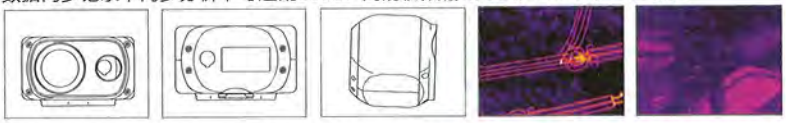
HL-640/320S

专为轻型无人机设计，重量≤210g,全动态精准测温，16位全画副实图录像，可选配1080P 高清视频输出 SDI、HDMI、YUV接口，可选配GPS卫星定位



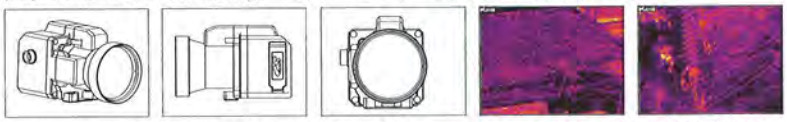
HL2-640

专为轻型无人机设计，重量≤310g,高清可见光加加640x480像数热像仪，全动态精准测温，数据同步记录，同步分析，可选配1080P 高清视频输出 SDI、HDMI、YUV接口



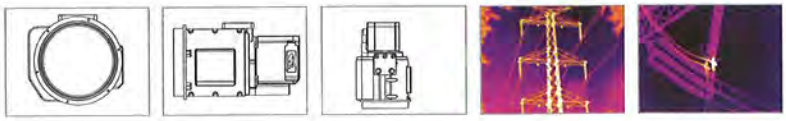
HL-640L（长焦型）

专为轻型无人机设计，重量≤320g,50mm长焦镜头，可远距离发现目标，全动态精准测温，可选配1080P 高清视频输出 SDI、HDMI、YUV接口，可选配GPS卫星定位



HL-640KZ（双视场切换型）

专为轻型无人机设计，重量≤710g,双视场切换，全动态精准测温，可轻松识别800m外人体目标，可选配1080P 高清视频输出 SDI、HDMI、YUV接口，可选配GPS卫星定位



企业主要产品系列 Product Line

红外气体检漏成像仪

KC1000 高清制冷型红外热像仪

采用640X480像素制冷型探测器，体积小重量轻，可搭载在轻型无人机、机器人等设备上。

GL1000F 甲烷及有机气体红外检漏仪

采用320x240像素制冷型探测器，双视场检测模式，准确定位泄露位置，可搭载在轻型无人机、机器人等设备上

小型无人机专用红外吊舱

KS-U130 小型无人机专用双通道吊舱

体积小,重量轻,可搭载于无人直升机,固定翼,多旋翼等各种飞行器

KS-U100 小型无人机专用红外吊舱

三轴设计,体积小,多重轻,高清红外,可实现全动态红外精准测温可搭载于无人直升机,固定翼,多旋翼等各种飞行器

无人机用光电吊舱系统

该产品是专为中型无人机打造的一款用于低空侦察,观测的小型设备，主要用于现场侦察、森林防火、地面缓救、地形地貌侦察等领域。

红外热像检测系统

直升机电力线巡检系统KS-H

高压输电线路电力线巡检系统，针对有人直升机开发，包含吊舱控制系统以及地面数据分析系统，给客户提供整套完善的系统解决方案。

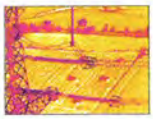




无人机红外热成像系统

高集成度的红外热像仪测温组件与无人机的飞控系统深度整合，组成完善的电力巡线系统。

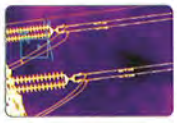




变电站红外监测系统

用于变电站安防监控及设备高温预警，能对变电设备进行多个红外热像及可见光视频同时监控，并自动采集报警数据生成检测报告。





主要业绩：

河南南阳1000KV特高压变电站
山西长治1000KV特高压变电站
云南玉溪江川变电站
湖北襄阳变电站 等

电气化铁路车载接触网运行状态检测装置

也适用于地铁

高速铁路车载接触网运行状态检测装置

Keii 科易光电
GUANGZHOU KEII ELECTRO OPTICS TECHNOLOGY CO.,LTD.

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广州科易光电技术有限公司

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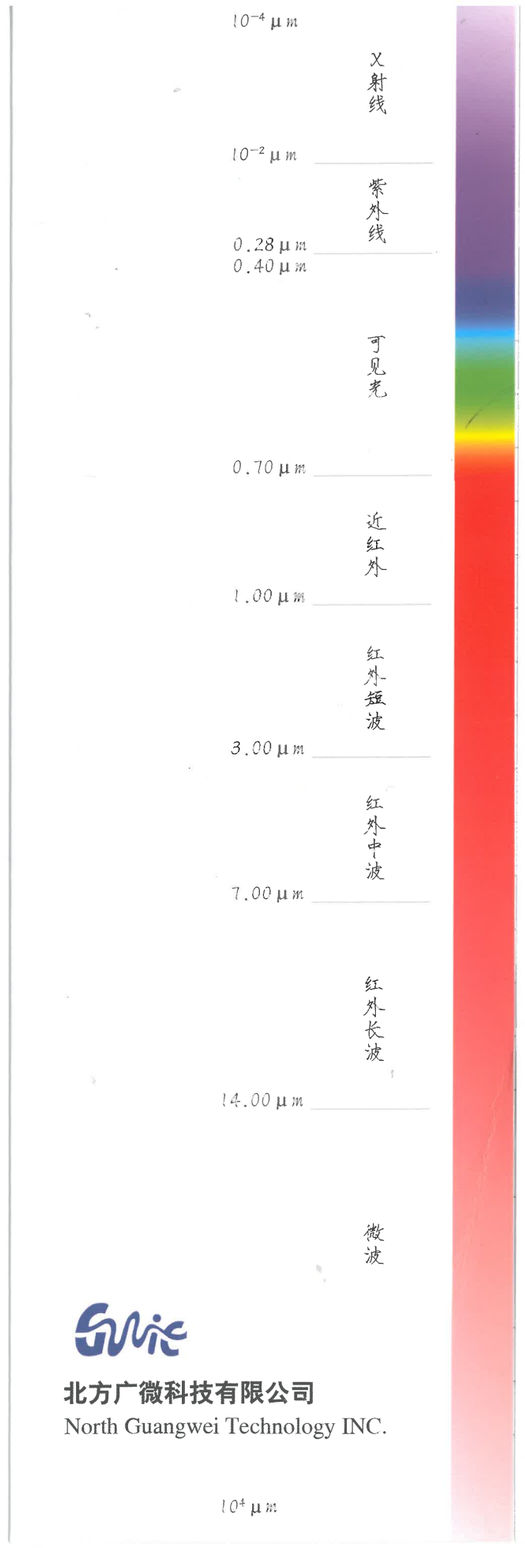
公司网站： www.keii.com.cn
电子邮箱： keii@keii.com.cn



中国兵器工业集团 NORINCO GROUP

北方夜视科技集团有限公司

North Night-Vision Science & Technology Group Corp., Ltd

北方广微科技有限公司

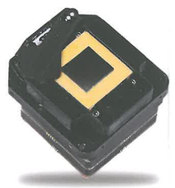
North Guangwei Technology INC.

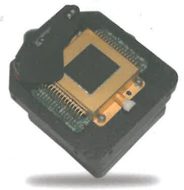
8.00 μm

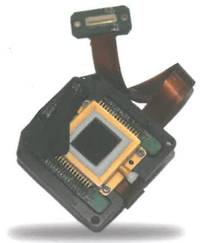
非制冷型红外焦平面探测器及机芯组件

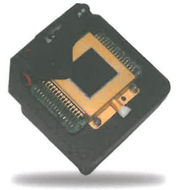
Uncooled FPA LWIR Detectors and Cores

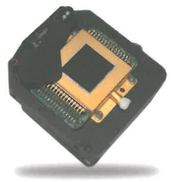
14.00 μm











产品名称	GW5.2 02 02 X1A GW5.2 02 03 X1A	GW5.3 02 02 X1A GW5.3 02 03 X1A	GW5.4 02 02 X1A GW5.4 02 03 X1A	GW5.5 02 02 X1A GW5.5 02 03 X1A	GW5.6 02 02 X1A GW5.6 02 03 X1A	GW5.7 02 02 X1A GW5.7 02 03 X1A
探测器类型	广微VOx非制冷长波红外焦平面	广微VOx非制冷长波红外焦平面	广微VOx非制冷长波红外焦平面	广微VOx非制冷长波红外焦平面	广微VOx非制冷长波红外焦平面	广微VOx非制冷长波红外焦平面
探测器参数	384×288，25μm / 20μm	384×288，25μm/20μm	384×288，25μm/20μm	384×288，25μm/20μm	384×288，25μm/20μm	384×288，25μm/20μm
NETD（@1/f，30 0k，25Hz）	≤50mK	≤50mK	≤50mK	≤50mK	≤50mK	≤50mK
功耗	≤1.8W（@25℃）	≤2W（@25℃）	≤1.8W（@25℃）	≤1.8W（@25℃）	≤1.8W（@25℃）	≤1.8W（@25℃）
工作温度范围	—40℃ ～ +60℃	—40℃ ～ +60℃	—40℃ ～ +60℃	—40℃ ～ +60℃	—40℃ ～ +60℃	—40℃ ～ +60℃
储存温度范围	—50℃ ～ +70℃	—50℃ ～ +70℃	—50℃ ～ +70℃	—50℃ ～ +70℃	—50℃ ～ +70℃	—50℃ ～ +70℃
工作波段	8-14μm	8-14μm	8-14μm	8-14μm	8-14μm	8-14μm
供电范围	DC6.5V～13V	DC6.8V～12V	DC3.7V～11V	DC6.5V～13V	DC6.5V～13V	DC3.7V～11V
启动时间	≤20s	≤20s	≤20s	≤20s	≤20s	≤20s
调焦电机驱动	PWM调节	N	N	PWM调节	PWM调节	N
数字视频输出	N	1路OLED数字直接驱动	1路OLED数字直接驱动	一路Cameralink输出(14Bit)		1路OLED数字直接驱动
视频输出	模拟视频输出，PAL制式	模拟视频输出，PAL制式	模拟视频输出，PAL制式	模拟视频输出，PAL制式	双路模拟视频输出，PAL制式	模拟视频输出，PAL制式
通讯方式	RS232串口	RS232串口	RS232串口	RS232串口	RS232、RS485、RS422串口可选	RS232串口
热源告警	通过串口发送报警目标信息； 通过串口设置一帧图像报警目标最大数量； 通过串口设置告警目标大小范围。	N	N	N	N	N
主要控制功能	手动背景校正、手动快门校正、极性设置、2倍电子放大、十字叉显示、图像增益调节、图像亮度调节、十字叉位置调节、图像增强、电动调焦、系统参数复位	手动背景校正、手动快门校正、极性设置、2倍电子放大、十字叉显示、图像增益调节、图像亮度调节、十字叉位置调节、图像增强、字符OSD、系统参数复位	手动背景校正、手动快门校正、极性设置、2倍电子放大、图像增益调节、图像亮度调节、图像增强、字符OSD、系统参数复位	手动背景校正、手动快门校正、极性设置、2倍电子放大、十字叉显示、图像增益调节、图像亮度调节、十字叉位置调节、图像增强、电动调焦、系统参数复位	手动背景校正、手动快门校正、极性设置、2倍电子放大、十字叉显示、图像增益调节、图像亮度调节、十字叉位置调节、图像增强、电动调焦、系统参数复位	手动背景校正、手动快门校正、极性设置、2倍电子放大、图像增益调节、图像亮度调节、图像增强、系统参数复位
尺寸	≤49mm×46mm×42mm （包含挡片电机和结构件）	≤49mm×46mm×45mm	≤46mm×47mm×22mm	≤49mm×46mm×42mm （包含挡片电机和结构）	≤49mm×46mm×42mm （包含挡片电机和结构）	≤49mm×46mm×45mm
重量	＜100g（包含挡片电机和散热结构件）	＜100g	＜65g	＜100g（包含挡片电机和散热结构件）	＜100g（包含挡片电机和散热结构件）	＜65g（包含挡片电机和散热结构件）

North Real Estate Building, No.81, ZiZhuYuan Road, HaiDian District, Beijing, PRC
Tel:+86 10 88829628
Email: sales@gwic.com.cn

北京市海淀区紫竹院路81号 北方地产大厦16层
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Email: sales@gwic.com.cn

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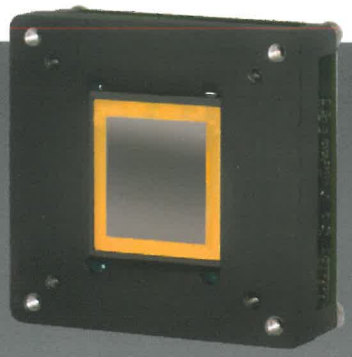
Exhibit B – Part 4

兆晟科技股份有限公司
SUN CREATIVE TECHNOLOGIES INC
TM

V700 高灵敏度红外热像组件



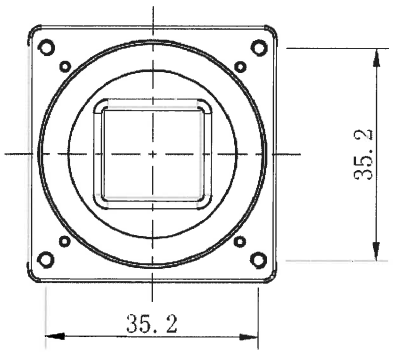
产品特点：

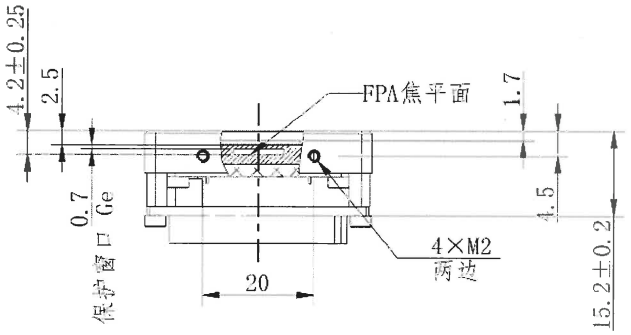
- 专利无挡片技术(NST)
- 超高灵敏度:45mk
- 极低功耗:＜0.85W
- 瞬时开机:＜3S
- 实时无延时热像输出
- 低工作电压:2.5V~5.5V
- 小尺寸(42.5x41x20mm)重量轻(＜40g)
- 抗热冲击性高，环境适应性强
- 结构加固性能好，抗强冲击振动

兆晟科技股份有限公司
SUN CREATIVE TECHNOLOGIES INC.

V700 高灵敏度红外热像组件技术参数

特点	性能	高灵敏度(V700)
探测器性能	探测器类型	氧化钒
	分辨率/像元间距	384x288/17um
	灵敏度	≤45mk@300K,50HZ
	帧频	50Hz
	响应波段	8~14um
图像处理	非均匀校正技术	采用NST专利无挡片技术
	开机时间	<3S
	图像降噪	数字滤波
	图像显示分辨率	768x576
	图像帧频	50Hz(PAL)/60Hz（NTSC）
	镜头	可选配19mm,40mm,50mm,75mm,100mm,150mm
	极性反转	黑热/白热
	图像镜像	水平/垂直
热像调节	图像放大	x2,x4
	自动增益	自动调节
电 源	工作电压范围	DC:+2.5V~+5.5V
	典型工作电压	DC:3.6V
	功耗	<0.85W
	反接保护	有
	过欠压保护	有
环境参数	工作温度范围	商用：-20℃~+60℃
		特殊用途：-40℃~+60℃
	存储温度范围	-45℃~+65℃
	湿度	5%~95%无结露
	抗振动冲击	振动：GJB 150-16 2.3.1
		冲击：GJB 150-18 试验7 100g/6ms
	抗温度冲击	-5℃/min(-40℃~+60℃)
物理参数	重量(不带镜头和后罩)	<40g
	尺寸(不带镜头和后罩)	42.5mmx41mmx20mm/42.5mmx51mmx20mm
对外接口	外部电源输入接口	有
	通讯口	RS-232
	模拟视频输出口	BNC(75Ω);支持两路复合视频
	数字视频输出口(可定制)	16Bit(50Hz)
	键盘	4按键键盘





nsis 无挡片热像系统 专利技术

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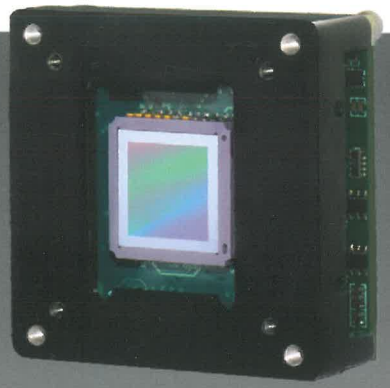
浙江省杭州市余杭区五常大道181号 邮编: 310023 电话: 0571-89300280 传真: 0571-89301932 邮箱: sales@suncti.com

兆晟科技股份有限公司
SUN CREATIVE TECHNOLOGIES INC
TM

M702 高灵敏度红外热像组件



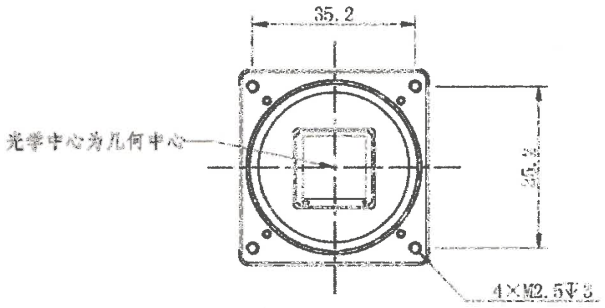
产品特点：

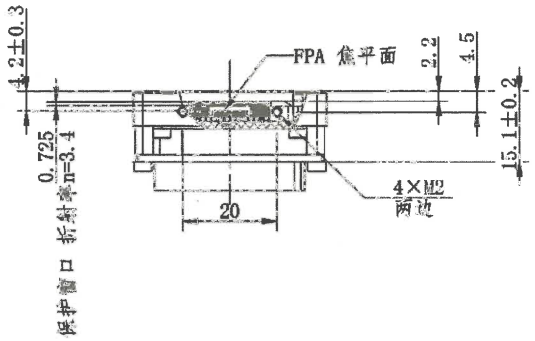
- 专利无挡片技术(NST)
- 超高灵敏度:50mk
- 极低功耗:＜0.65W
- 瞬时开机:＜3S
- 实时无延时热像输出
- 低工作电压:2.5V~5.5V
- 小尺寸(42.5x41x20mm)重量轻(＜40g)
- 抗热冲击性高，环境适应性强
- 结构加固性能好，抗强冲击振动

兆晟科技股份有限公司
SUN CREATIVE TECHNOLOGIES INC.

M702 高灵敏度红外热像组件技术参数

特点	性能	高灵敏度(M702)
探测器性能	探测器类型	非晶硅红外微测辐射热计
	分辨率/像元间距	384x288/17um
	灵敏度	≤50mk@300K,50HZ
	帧频	50Hz
	响应波段	8~14um
图像处理	非均匀校正技术	采用NST专利无挡片技术
	开机时间	<3S
	图像降噪	数字滤波
	图像显示分辨率	768x576
	图像帧频	50Hz(PAL)/60Hz（NTSC）可选
	镜头	可选配12mm,19mm,40mm,50mm,75mm,100mm,150mm
	极性反转	黑热/白热
	图像镜像	水平/垂直
热像调节	图像放大	x2,x4
	自动增益	自动调节
电 源	工作电压范围	DC:+2.5V~+5.5V
	典型工作电压	DC:3.6V
	功耗	<0.65W
	反接保护	有
	过欠压保护	有
环境参数	工作温度范围	商用：-20℃~+60℃
		特殊用途：-40℃~+60℃
	存储温度范围	-45℃~+65℃
	湿度	5%~95%无结露
	抗振动冲击	振动：GJB 150-16 2.3.1
		冲击：GJB 150-18 试验7 100g/6ms
	抗温度冲击	-5℃/min(-40℃~+60℃)
物理参数	重量(不带镜头和后罩)	<40g
	尺寸(不带镜头和后罩)	42.5mmx41mmx20mm/42.5mmx51mmx20mm
对外接口	外部电源输入接口	有
	通讯口	RS-232
	模拟视频输出口	BNC(75Ω);支持两路复合视频
	数字视频输出口(可定制)	16Bit(50Hz)
	键盘	4按键键盘





nsis 无挡片热像系统

专利技术

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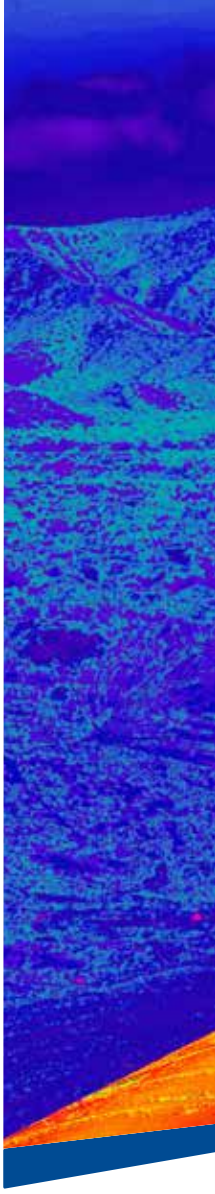

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HIKVISION

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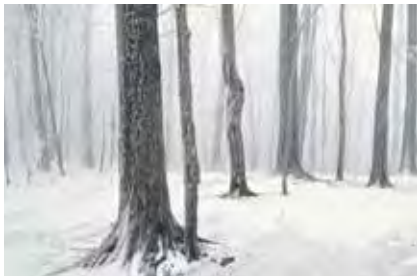
OBSERVE THE WORLD IN A DIFFERENT WAY HIKVISION THERMAL CAMERAS

All objects with a temperature above absolute zero emit thermal radiation, even at low levels. This kind of radiation, invisible to the human eye, can be detected by thermal camera sensors. The warmer an object is, the more thermal radiation it will emit. Thermal cameras can render images in the visual spectrum by detecting temperature differences between an object and its surroundings. The larger the difference, the bigger the contrast variety, making details visible. Compared to visible-light cameras, thermal cameras can be used for applications in more challenging environments.



Excellent Environmental Adaptability

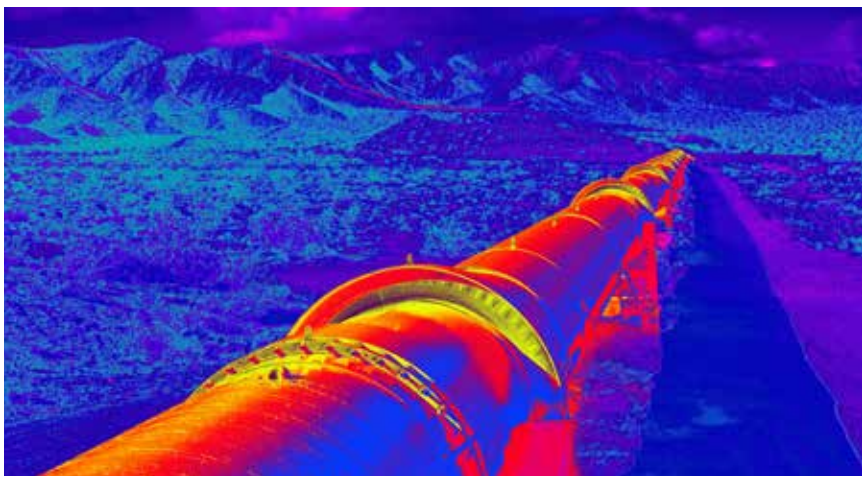
Thermal sensors are not affected by changing light conditions, total darkness, or other challenging weather, such as rain, fog or snow. This makes thermal cameras a perfect platform on which to build more efficient, 24/7 surveillance systems.

Advanced Detection Ability

Integrated with intelligent video applications, such as line crossing and intrusion detection, these cameras can automatically trigger an alert and at the same time trigger a traditional pan / tilt / zoom camera to supply pertinent video to an operator. This application becomes especially effective in theft prevention and border enforcement applications.

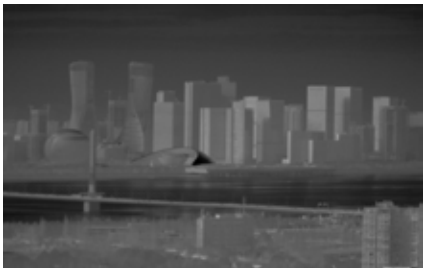
Temperature Sensing

Thermal cameras can monitor temperatures of specified objects; if temperatures exceed or fall below a certain limit, an alarm will be triggered. They can also track highlighted temperature-spans in an image through isothermal palettes. This enables an interpretation of events in a scene. Thermal cameras are the ideal choice for the prevention of fires, equipment over-heating, damage caused by freezing, and many other hazards.

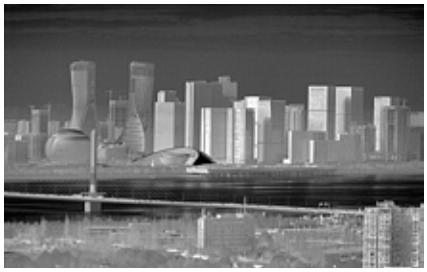


Hikvision's Thermal Technology Advantages

Image Signal Proces Algorithm



Linear AGC



Adaptive AGC

Auto Gain Control (AGC):

Adjusts the dynamic range of an image & retains permeability. "Adaptive" AGC – a feature of Hikvision thermal cameras – is a more advanced algorithm than "linear" AGC, found in other manufacturers' cameras.

DDE Off

DDE On

Digital Detail Enhancement (DDE):

Based on an enhanced algorithm for a region of interest, ensures images display more details.

3D DNR Off

3D DNR On

3D Digital Noise Reduction (DNR):

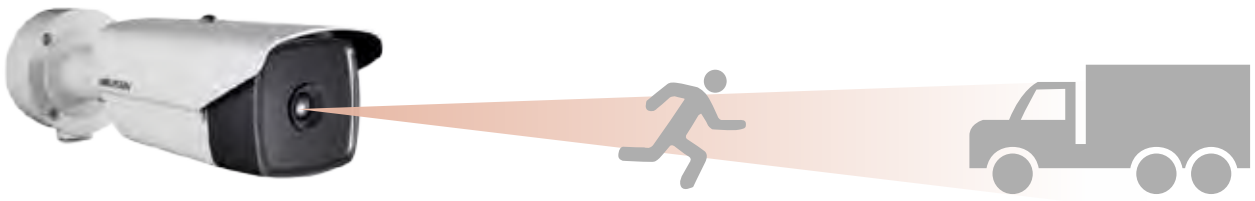
Through noise reduction processing of the original signal, hot pixels are minimized, rendering more refined images.

Wide Coverage Range for Any Application

Pixel Pitch = 25 μm

Lens (Focus)	25 mm	50 mm	75 mm
Detection Range (Vehicle)	1,500 m	3,060 m	4,600 m
Detection Range (Human)	500 m	1,000 m	1,500 m
Recognition Range (Vehicle)	380 m	760 m	1,150 m
Recognition Range (Human)	120 m	250 m	370 m
Identification Range (Vehicle)	190 m	380 m	570 m
Identification Range (Human)	60 m	120 m	180 m

Applicable Models: DS-2TD2235D-25/50; DS-2TD4035D-25/50; DS-2TD6135-50B2L/75B2L; DS-2TD6135T-25A2L/50A2L



Pixel Pitch=17μm

Lens (focal length)	10 mm	15 mm	25 mm	35 mm	50 mm	75 mm
Detection range (Vehicles)	900 m	1,350 m	2,250 m	3,150 m	4,510 m	6,760 m
Detection range (Humans)	290 m	440 m	730 m	1,020 m	1,470 m	2,200 m
Recognition range (Vehicles)	220 m	330 m	560 m	780 m	1,127 m	1,691 m
Recognition range (Humans)	70 m	110 m	180 m	250 m	360 m	550 m
Identification range (Vehicles)	110 m	160 m	280 m	390 m	560 m	840 m
Identification range (Humans)	30 m	50 m	90 m	120 m	180 m	270 m

Applicable Models: DS-2TD2136-10/15/25; DS-2TD2166 (T) -15/25/35; DS-2TD6166-50B2L/75B2L; DS-2TD6166T-25A2L/50A2L

Ranges are calculated according to Johnson's criteria in good weather conditions

A Complete Range of Thermal Products

Combining self-developed thermal imaging technology with Hikvision's extensive experience in the video surveillance field, we are equipped to provide a full range of thermal products – all of which are able to meet our customers' various requirements.

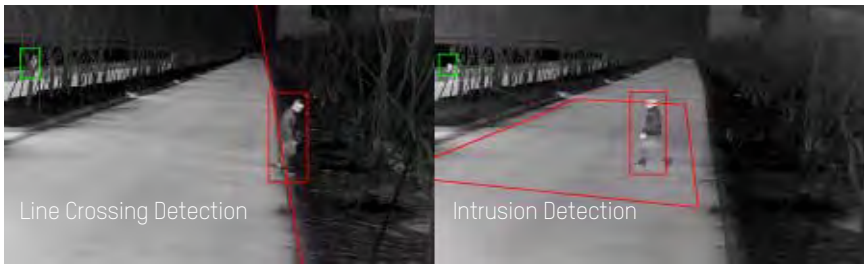
The single-lens bullet cameras provide an economical total cost of ownership, and the dual-lens products – bullet cameras, speed domes, and positioning systems – offer pan & tilt flexibility and simultaneous video streams that include both visible light and thermal imaging.

Thus, complex functions can be achieved. For example, bi-spectrum linkage can trigger automatic optical tracking if thermal units detect a target, and the fire detection function can locate fires and auto-matically zoom in with a traditional camera for visible confirmation.

To meet accurate temperature-measuring requirements, we created thermometric bullet & PTZ cameras, which support point, line, and frame temperature measurement types. Users can set upper and lower temperature limits. When the temperature exceeds set limits, an alarm will be triggered.

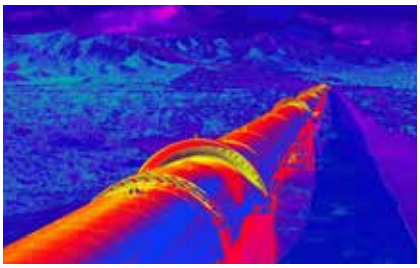
We have also introduced handheld thermal devices for industrial testing or outdoor activities. It's easy to carry and records precise measurements.

Applications



Perimeter Protection (Key-Region Intelligent Preventions)

Rapid target lock and alarm triggering, even in complete darkness and challenging conditions such as rain, smoke, dust and snow



Protection of Borders & Coastlines

Long-range object detection,not influenced by weather conditions

Fire & Theft Prevention in Warehouse Settings

Thermal cameras can detect temperature anamolies of a starting fire before the smoke is detected by a conventional fire detector. Even in low contrast situations the thermal cameras can detect humans in a very early stage.

Thermometry to Avoid Damage

The thermometry inside the camera can help you detect temperature deviations in an early stage to prevent damage due to overheating.

Reference Install

Electric temperature monitoring in energy substation – Ecuador

A total of 60 cameras were installed, providing dedicated client use for temperature measurement and monitoring, and running on a third-party grid platform.
This system implements preventive detection of operating events and monitors the main parts of the substation, such as insulators, transformers, and more. Once a device is found to exceed the normal operating temperature, alarm information is generated.

Coastal defense project – Chao Zhou, China

Surveillance of seafaring vessels to prevent smuggling or other violations in ocean environments is especially tough. Hikvision Thermal PTZ Cameras solve this problem, providing security personnel with sharp imaging and smart functionality.

PRODUCT FEATURES

Handheld Thermometric Thermal Camera
DS-2TP03-113V/W

- Thermal resolution: 384 × 288 / 17 μm
  Visible resolution: 8 MP
- 15 mm (25°) thermal lens
- 3.5" touch screen
- -20° C – 550° C (-4° F – 1,022° F) temperature range
- Max. ± 2° C, ± 2% temperature accuracy
- 64 GB SD card
- >4 hours operating time on single charge
- IP66 Protection rating

Handheld Observational Thermal Camera
DS-2TS03-068U/W
DS-2TS03-049U/W

- Thermal resolution: 384 × 288 / 17 μm
- 25 mm (15°) or 35 mm (10°) thermal lens option
- 0.39" OLED, 1024 × 768
- 32 GB MicroSD card
- Hot-spot tracking
- Support Wi-Fi
- >5 hours operating time on single charge
- IP67 Protection rating
- 2 m Drop tested

Thermal Network Single-Lens Bullet Camera
DS-2TD2136-10/15/25

- Thermal resolution: 384 × 288
- 10 mm (36°) / 15 mm (24°) / 25 mm (15°) thermal lens option
- Support line crossing and intrusion detection
- Support temperature anomaly alarm
- Support fire detection

Thermal Network Single-Lens Bullet Camera
DS-2TD2166-15/25/35
DS-2TD2166T-15/25/35

- Thermal resolution: 640 × 512
- 15 mm (39°) / 25 mm (24°) / 35 mm (17°) thermal lens option
- Support line crossing and intrusion detection
- Support temperature anomaly alarm
- Support fire detection
- -T: -20° C – 550° C (-4° F – 1,022° F) temperature range, max. ± 2° C, ± 2% temperature accuracy (only DS-2TD2166T supported)
- IP66 Protection rating

PRODUCT FEATURES

Observable Thermal + Optical Bi-spectrum Network PTZ Camera
DS-2TD6135-50/75B2L
DS-2TD6166-50/75B2L

- Thermal resolution: 384 × 288 / 640 × 512
  Visible resolution: 1920 × 1080
- Visible-light lens: 8–250 mm, 32x optical zoom, 16x digital zoom
- Thermal lens: 50 mm (6135: 11°, 6166: 12.4°) / 75 mm (6135: 7.3°, 6166: 8.3°) thermal lens option
- 360° Endless pan range, +40° to -90° tilt range
- Support line crossing and intrusion detection with smart tracking linkage
- Support temperature anomaly alarm
- Support fire detection
- Up to 500 m IR distance
- IP66 Protection rating

Thermometric Thermal + Optical Bi-spectrum Network PTZ Camera
DS-2TD6135T-25/50A2L
DS-2TD6166T-25/50A2L

- Thermal resolution: 384 × 288 / 640 × 512
  Visible resolution: 1920 × 1080
- Visible-light lens: 4.5–135 mm, 30x optical zoom, 16x digital zoom
- Thermal lens: 25 mm (6135T: 21°, 6166T: 24°) / 50 mm (6135T: 11°, 6166T: 12.4°) thermal lens option
- 360° Endless pan range, +40° to -90° tilt range
- -20° C – 550° C (-4° F – 1,022° F) temperature range, max. ± 2° C, ± 2% temperature accuracy
- Support line crossing and intrusion detection with smart tracking linkage
- Support fire detection
- Up to 150 m IR distance
- IP66 Protection rating

Thermal + Optical Bi-spectrum
Network Speed Dome
DS-2TD4035D-25/50

- Thermal resolution: 384 × 288
  Visible resolution: 1920 × 1080
- Visible-light lens: 4.3–129 mm, 30x optical zoom, 16x digital zoom
- Thermal lens: 25 mm (21.7°) / 50 mm (11°) thermal lens option
- 360° Endless pan range, -15° to 90° tilt range
- Support line crossing and intrusion, which can be linked to auto tracking
- Support temperature anomaly alarm
- Support fire detection
- Up to 150 m IR distance
- IP66 Protection rating

Thermal + Optical Bi-spectrum Network Bullet Camera
DS-2TD2235D-25/50

- Thermal resolution: 384 × 288
  Visible resolution: 1920 × 1080
- Visible-light lens: Darkfighter Ultra low light
- Thermal lens: 25 mm (21.7°) / 50 mm (11°) thermal lens option
- Support line crossing and intrusion
- Support temperature anomaly alarm
- Support fire detection
- Up to 120 m IR distance
- IP66 Protection rating

COOLED INFRARED DETECTORS

GLOBAL
SENSOR
TECHNOLOGY www.gst-ir.com

Model	C330S LWIR	C615S LWIR
Material	T2SL	T2SL
Resolution	320×256	640×512
Pixel Pitch	30μm	15μm
Spectral Range	7.7μm~9.5μm	7.7μm~9.5μm
Work Mode	Snapshot;integration then read-out;window mode;anti-blooming	snapshot; integration then read-out; integration while read-out; windowmode; anti-blooming
Charge Capacity	36Me- (Gain=0) or 12Me- (Gian=1)	IWR mode: ≥7.8Me- (Gain=0) or 5.2Me- (Gain=1) ITR mode: ≥9.1Me- (Gain=0) or 6.5Me- (Gain=1)
Electrical Dynamic Range	≥80dB	≥75dB
Output Channel	1 or 4; single channel max output speed>6.6MHz	4; max output speed>10MHz
Typical NETD	≤15mk (F/2)	≤25mk (F/2)
Typical Array Operability	99%	99%
Non-uniformity of response	≤5%	≤5%
Cooler Applied	**RS058**	**RS046**
Cooler Mode	Integral Rotary Stirling Cooler	Integral Rotary Stirling Cooler
Steady Power Consumption	<7W	<7W
Max. Power Consumption	<14W	<12W
FPA Working Temperature	<100K	<100K
Power Supply	24VDC	32VDC
Cool Down Time	<6min	<6.5 min
Weight	<600g	<450g
Dimension	142x58x71mm	122x80x46mm
Working Temperature	-40℃-+71℃	-40℃-+71℃

C125M MWIR	C330M MWIR	C615M MWIR
MCT	MCT	MCT
128×128	320×256	640×512
25μm	30μm	15μm
3.7μm~4.8μm	3.7μm~4.8μm	3.7μm~4.8μm
snapshot;integration then read-out;anti-blooming	snapshot,integration then read-out;window mode; anti-blooming	snapshot; integration then read-out; integration while read-out; window mode; anti-blooming
18Me-	36Me- (Gain=0) or 12Me- (Gian=1)	IWR mode: ≥7.8Me- (Gain=0) or 5.2Me- (Gain=1) ITR mode: ≥9.1Me- (Gain=0) or 6.5Me- (Gain=1)
≥80dB	≥80dB	≥75dB
6MHz	1 or 4; single channel max output speed>6.6MHz	4; max output speed>10MHz
≤15mk (F/2)	≤10mk (F/2) ≤15mk (F/4)	≤18mk (F/2) ≤25mk (F/4)
99%	99%	99%
≤5%	≤5%	≤5%

JT	RS058	RS046	RS046H
Conical Joule-Thomson cryo-cooler	Integral Rotary Stirling Cooler		Split Rotary Stirling Cooler
/	<7W	<6.5W	<5W
/	<14W	<12W	<12W
/	<100K	<100K	<110K
/	24VDC	32VDC	28VDC
<7s(42Mpa Ar, 20℃)	<6min	<6.5 min	<6.5 min
<80g	<600g	<450g	<350g
Φ35x42.5mm	142x58x71mm	122x80x46mm	45x34x67mm(Cooler) Φ38x95mm(Dewar)
-40℃-+71℃	-40℃-+71℃	-40℃-+71℃	-40℃-+71℃

COMPANY

Wuhan Global Sensor Technology Co., Ltd (GST) is a subsidiary of Wuhan Guide Infrared Co., LTD. GST specializes in the design and manufacture of infrared thermal imaging detectors. It has world first-class R&D and production line for cooled FPA infrared detectors and the only 8 inch 0.25 μ m MEMS production line for VOx and a-Si infrared detectors in China. The company owns the whole process technology and capability with full intellectual property rights, covering the purification of element, mono-crystal, growth of sensitive materials, FPA processing, cooler design and manufacturing, DDCA integration, various processing test etc. GST thermal imaging detectors and coolers have been widely used in thermography, security & surveillance, automotive, consumer infrared and military applications. The mass production capability of GST enables it to meet the growing demand from all existing and emerging markets.

www.gst-ir.com

GLOBAL
SENSOR
TECHNOLOGY

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Guide

GUIDIR® IR518

Monocular Handheld Thermal Imager

GUIDIR® IR518

With newly adopted thermal vision technology, IR518 series set a new standard for small, light weight thermal imaging cameras. Compact design and hand-sized structure allows for easy carrying and operation. Thermal image and video storage function helps you to store the detection process as an evidence for review. The perfect hermetic structure and encapsulation realize overall protects for IR518 series and makes them perfect for public safety, police office and security operations.

Applications

Search and rescue
Security monitoring
Portable law enforcement
Border security
Routine patrols

Features and Benefits

Light-weight and compact design
Day & night easy operation
Image capture, mission reporting
Waterproof and shockproof
License free and rapid delivery

	IR518	
Image Performance		
Detector Type	Uncooled FPA	
Spectral Range	8-14μm	
Pitch	25μm	
Pixels	160x120/384x288	
NETD	≤100mK/≤80mK	
Optics		
Focal Length/F#	25mm/F=1 50mm/F=1.1	
FOV	160x120 detector	384x288 detector
	4.58° x3.44° (50mm)	10.97° x8.24° (50mm)
	9.15° x6.87° (25mm)	21.74° x16.39° (25mm)
Image Presentation		
Video Output	PAL	
Brightness/Contrast	Auto & manual control	
Polarity	White hot/black hot	
Electronic Zoom	x2	
Image Display	OLED viewfinder	
Image Storage		
Type	Removable 4GB SD card	
File Format	JPG	
Video Recording	Yes	
Power		
Power Supply	4 AA lithium or alkaline batteries	
Battery Operating Time	3 hours continuous operation	
Interfaces		
Video Output	Analog composite video output	
Environmental Specification		
Operating Temperature	-10℃to +45℃	
Storage Temperature	-20℃to +50℃	
Humidity	Operating and storing 10% to 95%, non-condensing	
Encapsulation	IP67	
Water & Shock Resistance	Waterproof to 1m submersion, shockproof to 1m drop	
Physical Characteristics		
Size	182mmx97mmx68mm	
Tripod Mounting	1/4" -20	
Weight	0.75kg(without batteries)	

Guide

Thermal Imaging Navigation Assistant System

N-Boat™

With compact design, hermetic structure, and stabilized pan&tilt, N-Boat offers fast and high-quality imaging in wide FOV, and is perfect for any vessel in any harsh weather. Detecting floating objects, channel marking, channel flow, other vessels, pier, avoiding pirates, presenting hidden vessels and objects neglected by sonar and radar system, even if it's in dense fog, heavy rain, heavy snow or total darkness, immune to thunderstorm, special geographic or contrived magnetic field, emitting no disturbing signal, N-Boat is fully capable to enhance the safety as well as the speed during sailing. N-Boat also plays an important role in maritime search and rescue. It can precisely detect victims according to the energy emitted.

No matter for fishing boat, ocean liner, luxury yacht or any other ships, no doubt that N-Boat is the best choice.

Applications

Day & Night navigations for vessels and boats
Increase safety and security on board
Short to medium range threat detection
Maritime rescue
Anti-piracy

Features and Benefits

High technology infrared night vision system
Fast imaging speed and high image quality
Wide field of view
Hermetically sealed structure, capable in any harsh environments
Advanced gyro-stabilization
Light weight and compact, suitable for any types of vessels
High cost performance ratio, wide application
License free and rapid delivery

N-Boat™		
Imaging Performance		
	Version A	Version B
Detector Resolution	384×288	160×120
Pixel Size	25 μ m	25 μ m
Spectral Range	8 to 14 μ m	8 to 14 μ m
Field of View	21.6° (H)×16.2° (V)	9° (H)×7° (V)
Focus	25mm lens	25mm lens
Image Frequency	50Hz/60Hz	50Hz /60Hz
Video		
Output	RS170 PAL/NTSC composite video	
Power		
Input Voltage	9~15V DC	
Power Dissipation	3W	
Environmental Specifications		
Operating Temperature Range	-20℃ to +60℃	
Storage Temperature Range	-40℃ to +60℃	
Encapsulation	Hermetically sealed enclosure	
Physical Characteristics		
Camera Weight	4.77kg (excluding Pan/Tilt)	
Camera Size	∅200mm ×200mm(H) excluding Pan/Tilt	

a sense for innovation IEE

NightGuard™

More than the human eye can see

Regardless of how good their vision is, drivers can have difficulty recognizing pedestrians, cyclists or animals on the side of the road, or crossing from one side to the other at dusk, dawn, or at night. This issue is of particular concern in rural areas, where the streets are not well lit, or when visibility is otherwise poor, for example in rain, fog or light snow.

With a night vision system, however the driver can detect these vulnerable road users while the car is still at a safe distance – even when they are not within the range of the car's headlights.

NightGuard camera

The NightGuard solution

IEE's NightGuard recognizes the thermal signature of living beings and, by applying a sophisticated detection algorithm, generates a warning for the driver. The system recognizes pedestrians and animals, even when they have not yet been seen by the naked eye.

The camera does not require any light source, it uses natural thermal radiation. NightGuard sees living beings at a distance of 300 meters. Then 110 meters before the car reaches the person or animal, the system issues a corresponding warning on the vehicle's screen or via a head-up display.

Unlike human eyes or other cameras, NightGuard is not impacted by glare – the thermal images are always clear and easily recognizable. NightGuard is waterproof and operates over a wide temperature range and in a variety of weather conditions.

Due to its small size, NightGuard can easily be integrated into a vehicle's front grill. It also includes an automatic heating device that prevents system impairment resulting from ice deposits in frosty conditions.

Key Advantages

- **Easy integration:** Due to its small size, the camera can easily be integrated into the radiator grill of any passenger vehicle
- **A range of conditions:** NightGuard is suitable for a range of weather conditions, including rain, fog and light snow. It is also waterproof and operates over a wide temperature range
- **Robust technology:** NightGuard's optical window includes an automatic heating device to prevent system impairment due to ice deposits in frosty conditions
- **Reliability:** NightGuard offers excellent detection capabilities in conditions where visibility is poor and does not require any external light source

IEE is a recognized supplier of automotive safety sensors and electronics. Due to our considerable experience in detection algorithms and image processing, IEE is the perfect partner for your night vision needs.

a sense for innovation IEE

NightGuard™

An important contribution to road safety

NightGuard helps to prevent severe collisions with pedestrians and animals, which predominantly occur in conditions where there is poor visibility. In Europe, 51% of pedestrian fatalities occur in darkness (EU - 2010)

The Euro NCAP "2020 Roadmap" announced the introduction of "updated test & assessment procedures to encompass pedestrians and pedal cyclists in daylight, darkness and obscure lighting conditions" in 2018.

Japan NCAP plans to introduce a "night pedestrian detection warning" function into their rating scheme in 2016.

Long Wave Infrared (LWIR) and microbolometer technology

NightGuard consists of a small camera integrated into the radiator grill and a processing unit located in the vehicle's interior.

LWIR is the range of electromagnetic radiation, with a wavelength between 8 and 15 um. Every object naturally emits radiation in this range at ambient temperatures. The radiation intensity depends on the object's material and temperature.

NightGuard uses microbolometer technology to capture this radiation and convert it into a usable electrical signal. NightGuard processes the electrical signal to form a clear image for the driver and feed the detection algorithm. The difference in radiation between pedestrians, animals and the scenery makes robust detection possible, even in complete darkness.

About Us

IEE is an innovative developer of specialized sensing systems. Our sensing systems are dedicated to the following markets: Automotive, Building Management & Security, Medical, Health and Sports. IEE was founded in1989 and is headquartered in Luxembourg. We operate in Europe, the U.S. and Asia, and employ 1,900 people worldwide.

For more information, please visit **www.iee.lu**
or send an e-mail to transportation@iee.lu

FS-NightGuard-18-DEC-2014

Examples of Benefits of Infrared Detection Items from FLIR Systems, Inc.

Search and Rescue:

Darien Police Rescue Missing Teenage Boater from Broken-down boat
Darien Times
February 2017
http://www.darientimes.com/81224/darien-police-rescue-missing-teenage-boater-from-broken-down-boat/

Missing Woman Found in Natchitoches Parish
ArkLaTex Homepage
February 2017
http://www.arklatexhomepage.com/news/local-news/multiple-agencies-search-for-missing-woman/648619253

'Ridiculous' number of missing kids in Oregon
KOIN-TV
February 2017
http://koin.com/2017/02/21/ridiculous-number-of-missing-kids-in-oregon/

Chaska grad rescued in Grand Tetons
Chanhassen Villager
February 2017
http://wate.com/2017/02/16/smokies-park-rangers-search-for-driver-who-ran-from-traffic-stop/

Infrared-equipped DJI drone helps locate missing skiers and snowboarders
Digital Circuit
February 2017
https://www.thedigitalcircuit.com/infrared-equipped-dji-drone-helps-locate-missing-skiers-and-snowboarders/

Coast Guard rescues man found alive, adrift on overturned boat
WCVB TV
February 2017
http://www.wcvb.com/article/coast-guard-finds-man-found-alive-adrift-on-overturned-boat/8959570

Missing Elderly Plymouth, Mass. Couple Found Safe
NECN
January 2017
http://www.necn.com/news/new-england/Elderly-Plymouth-Massachusetts-Couple-Reported-Missing-411281065.html

Blackhawk helicopters arrive in Gaitlinburg for water drops, search and rescue
November 2016
http://wate.com/2016/11/29/blackhawk-helicopters-arrive-in-gatlinburg-for-water-drops-search-and-rescue/

Examples of Benefits of Infrared Detection Items from FLIR Systems, Inc.

State Police Rescue two hikers on Mt. Tom with help from Air Wing
Western Mass News
Sept 2016
http://www.westernmassnews.com/story/32582037/state-police-rescue-two-hikers-on-mt-tom-with-help-from-air-wing

Toddler found alive in water after boat capsizes
September 2016
CNN
http://www.cnn.com/2016/09/02/health/beyond-the-call-of-duty-overturned-boat/index.html
Fox
http://fox40.com/2016/09/02/toddler-found-alive-in-water-after-boat-capsizes/

Mass State Police Airwing Locates Lost Hiker in Hadley
January 2016
https://www.facebook.com/MassStatePolice/videos/939595439457773/

UK Coast Guard saved 34 people trapped by the rising tide.
June 2016
http://www.itv.com/news/meridian/story/2016-06-07/dramatic-video-party-of-36-rescued-from-rocks-in-dover/

Helicopter called in to rescue man from side of train tracks in Weston-super-Mare
Mercury
December 2016
http://www.thewestonmercury.co.uk/news/in_pictures_helicopter_called_in_to_rescue_man_from_side_of_train_tracks_in_weston_super_mare_1_4801983

Thermal camera captures rescue of elderly Livingston Man
KTVQ Montana
February 2016
http://www.ktvq.com/story/31227554/thermal-camera-captures-rescue-of-elderly-livingston-man

Thermal images captured of Murrells Inlet kayakers rescue
WBTW TV
January 2017
http://wbtw.com/2017/01/16/thermal-images-captured-of-murrells-inlet-kayakers-rescue/

Watch: Coast Guard rescues stranded kayakers
KOIN TV
March 2016
http://koin.com/2016/03/17/watch-coast-guard-rescues-stranded-kayakers/

Dramatic Rescue Off Lauderdale After Mega-Yacht Sinks
January 2016
http://miami.cbslocal.com/2016/01/26/dramatic-rescue-off-lauderdale-after-mega-yacht-sinks/

Examples of Benefits of Infrared Detection Items from FLIR Systems, Inc.

Montana National Guard Rescues Lost Hikers Near West Yellowstone
KXLH
August 2015
http://www.kxlh.com/story/29846285/montana-national-guard-rescues-lost-hikers-near-west-yellowstone

FLIR-equipped Drone Finds Missing Hiker lost in Woods
PRWeb -
September 2014
http://www.prweb.com/releases/2014/09/prweb12152416.htm

Few of these are our own coverage:
Local Heroes: Raymarine Ambassador Helps with Sea Rescue
http://www.flir.com/home/news/details/?ID=76472

Local Heroes: FLIR Marine Camera Helps Find Missing Girl
http://www.flir.com/home/news/details/?ID=75275

Anti-Poaching Efforts:

Thermal Imaging on Track to be next big thing for camera phones: Applications range from protecting wildlife to home improvements
Financial Times
December 2016
https://www.ft.com/content/4996ec04-8fb7-11e6-a72e-b428cb934b78

Watch Wildlife Rangers Nab Poachers With Thermal Imaging
Wired
December 2016
https://www.wired.com/2016/11/watch-wildlife-rangers-use-thermal-imaging-nab-poachers/

High-Tech Conservation: Drones & Thermal Cameras Squash Poaching
Discovery
November 2015
http://www.discovery.com/dscovrd/wildlife/high-tech-conservation-drones-thermal-cameras-squash-poaching/

How technology is helping catch nighttime poachers in Africa
Fox News
November 2015
http://www.foxnews.com/tech/2016/11/25/how-technology-is-helping-catch-nighttime-poachers-in-africa.html

Examples of Benefits of Infrared Detection Items from FLIR Systems, Inc.

Using Technology to Combat Wildlife Crime
National Geographic
November 2016
http://voices.nationalgeographic.com/2016/11/21/using-technology-to-combat-wildlife-crime/

Wildlife Rangers Are Using Military-Grade Technology to Catch Poachers, and It's Working
Huffington Post
November 2016
http://www.huffingtonpost.com/entry/wwf-thermal-imaging-poachers_us_583277b2e4b099512f83892a

Stalking Poachers with High-Tech Cameras and Old-Fashioned Smarts
NPR
April 2016
http://www.npr.org/sections/goatsandsoda/2016/04/13/474110188/stalking-poachers-with-high-tech-cameras-and-old-fashioned-smarts

Fighting Rhino Poaching with Spy Gear
CNN
http://www.cnn.com/videos/world/2012/02/28/curnow-safrcia-rhino-radar.cnn

Fire

One injured in boat fire at St. Augustine Marina
WJXT Jacksonville
February 2017
http://www.news4jax.com/news/florida/st-johns-county/st-augustine/boat-catches-fire-at-st-augustine-marina

Lake Assault Boat Assists with WI Boat Fire
Firehouse
October 2016
http://www.firehouse.com/press_release/12274104/lake-assault-boats-assists-with-wi-shipyard-boat-fire

Farmer gets chased by flames attempting to lay fire line
KHQ
August 2016
http://www.khq.com/story/32830354/incredible-video-farmer-gets-chased-by-flames-attempting-to-to-lay-fire-line

Local Heroes: Firefighters use FLIR Camera to Rescue Victim from Burning Home
http://www.flir.com/home/news/details/?ID=78768

March 14, 2016

Sent via email to: publiccomments@bis.doc.gov and DDTCPublicComments@state.gov
Regulatory Policy Division
Bureau of Industry and Security
U.S. Department of Commerce
Room 2099B
14th Street and Pennsylvania Avenue NW
Washington, DC 20230

and

Office of Defense Trade Controls Policy
Directorate of Defense Trade Controls
Bureau of Political Military Affairs
Department of State
Washington, DC 20522

Subjects: RIN 0694-XC035 – Increase of Controls: Infrared Detection Items and Notice of Inquiry: Request for Comment Regarding Unites States Munitions List Category XII

Dear Sir or Madam:

Fluke Corporation is pleased to have the opportunity to provide comment on the Administration's Notice of Inquiry regarding U.S. Munitions List Category XII ("USML NOI") and complementary Request for Inquiry regarding infrared detection systems described on the Export Administration Regulations ("EAR NOI"). The rewrite of USML Category XII and complementary EAR Revisions under the Export Control Reform ("ECR") was initiated to protect the commodities and components most important to our military, while providing relief to companies struggling with outdated and overly burdensome regulations by placing less sensitive items on the more flexible CCL. With respect to our industry, the proposals in the NOIs do not accomplish this objective and in some cases do quite the opposite.

Fluke provided extensive comments to BIS and DDTCs proposed revisions to the EAR (Category 6) and ITAR (Category XII) in 2015 and 2016. With respect to changes on the USML, Fluke objected to many of the changes in the May 5, 2015 proposal, but was very supportive of the proposed changes to the USML in Feb 19, 2016, as they relate to our business. Category XII in its current state meets the objectives of ECR in that the controls provide clarity and simplicity and limit the USML to the "crown jewels." Following the implementation of the final rule in October 2016, we were able to improve our procurement processes, expand international collaboration with our subsidiaries and partners, and reduce internal compliance roadblocks.

Several of the proposals in the USML NOI would re-open concerns that are very similar to those that were addressed in detailed comments by Fluke and several others to the May 5, 2015 proposed rules. In many places this USML NOI appears to ignore many of these earlier comments and the proposals would simply recreate problems that were addressed in the recently enacted changes. Though clear bright lines through performance parameters was a goal of the ECR process, this has proven difficult for some of the items listed in category XII, and earlier comments by industry led to the use of "specially designed" in the subsequent Feb 19, 2016 proposed rule and now in current regulations. This is the best solution for our industry. More details will be provided below, but some specific examples of this retread include: (1) infrared focal plane arrays ("IRFPAs") and their underlying read-out integrated circuit ("ROICs") are

inherently dual use, with a wide array of civil/commercial applications; (2) there are civil/commercial applications for head-mounted IR cameras and/or those with near-to-eye displays; and (3) there are civil/commercial applications that require and/or benefit from high shock tolerance.

In contrast, the revisions to EAR Category 6, as we discussed in our previous comments and have experienced as a result of the final rule, created new controls on items that were not previously controlled, increased licensing requirements, removed availability of license exceptions, and even imposed a presumption of denial for certain items, all of which appear to be contrary to the stated objectives of ECR, which was to focus high-level controls on the "crown jewels" of U.S. export controlled technology, and to increase regulatory flexibility with regard to less sensitive items. It is our concern that the proposals in the EAR NOI inflate this problem.

Under the current export control model, the U.S. thermal imaging industry is already at a competitive disadvantage against our foreign competitors. To be more competitive with foreign competitors, U.S. companies must find ways to reduce the impact of export control licensing hurdles. Therefore, many U.S. multi-national companies have chosen to move research, development and manufacturing to off-shore subsidiaries outside the U.S., and in some cases U.S. companies are fully outsourcing these functions to non-U.S. companies. The proposals in the EAR NOI adds to the already restrictive compliance burdens and dramatically limits U.S. companies' ability to compete with foreign competitors, reducing the economic viability of the U.S. thermal imaging industry.

While the stated goal of maintaining strict export controls around thermal imaging technology is to preserve U.S. technological and tactical advantages, as we have commented before, we are concerned that these changes will ultimately backfire, and lead to U.S. dependence on foreign technology and/or the loss of U.S. technological advantages in this area. The impact of these decisions will be felt by the U.S. commercial base and the U.S. Government. Advanced thermal imaging technology and products will soon be dominated by foreign industries. U.S. consumers – including the U.S. Government - will have to pay more for products produced outside the U.S. and the U.S. Government may lose access to domestic sources of the newest technologies, may become reliant on foreign sources for a critical tactical capability, and our war-fighters ultimately may be put at a disadvantage.

Fluke Corporation supports the U.S. Government's desire to protect U.S. technology and national security. Export controls play an important part in this endeavor. However, if the regulations are not carefully drafted to limit the strictest controls to products and technology that are critical to our national security, are equally protected by our allies, are not already in commercial use, and are not readily available in foreign markets, export controls begin to have the opposite effect.

I. USML NOI

a. Comments on Specially Designed for a Military End-User Parameters

In our view, the current use of "specially designed for a military end user" is appropriate and effective, in general and for the six types of items identified in the USML NOI. It's worth reiterating that any alternative to the current regulation would need to be very carefully drafted to (1) establish a clear/bright line; (2) avoid capturing civil/commercial items; and (3) give proper consideration to foreign availability of similar items. There are many examples of foreign availability of the six types of items, including in non-Wassenaar countries.[1] The in-depth review process that led to the just-released, current regulation

[1] **Exhibit A**: A recent Dali brochure picked up at the CIOE show in Shenzhen, Sept 2016, appears to show numerous examples of foreign availability of several of the six types of items addressed in the ITAR NOI. See in particular pp 4-10.

wrestled extensively with these matters for these six and other types of items; industry strongly objected and we're skeptical there are any easy/new answers now.

More specifically in regards to the second proposed control parameter ((c)(1) Binoculars, binoculars, etc.), the USML NOI uses terms that are not clearly defined and that potentially would, without the "specially designed" provision in the current regulation, be overly broad and capture civil/commercial products. Any alternative to the present control that were to omit the "specially designed" provision would need to clearly distinguish the commercial examples identified below from those used for military purposes.

1. Numerous handheld/portable industrial thermography cameras have a camcorder style eyepiece that, without further clarification, probably would be considered a near-to-eye display.[2] The eyepiece is needed for adequate viewing while outdoors in bright sunlight conditions. It is not clear whether these systems would be considered "monoculars" or "video-based articles having a separate near-to-eye display." Further, there is no clear definition of a "video-based article."
2. Scott Safety recently introduced a head-mounted thermal imager with a near-to-eye display for fire-fighting applications.[3]
3. Many IR cameras (and visible cameras) have connectivity options that enable them to work with commercial, off-the-shelf, head-mounted display glasses (e.g. such as "google glass," AR/VR goggles for gaming systems, etc.), either directly or indirectly via connections with smartphones or other devices that can easily be coupled with the above commercial displays. Indeed, emerging civil/commercial VR/AR display technologies are already rapidly being integrated with small infrared modules.[4]

b. Comments to Assist with the Evaluation of Potential Control Parameters

For technical parameters to be effective, especially if used in unilateral US controls, it is crucial that they be set at the right level -- a level that meets the national security goals of the US Government, but also accurately reflects what is available in the US vs. outside the US ("foreign availability"). Further, there would need to be a clear, objective and nimble process for periodically reviewing and adjusting the parameters as the foreign availability of technology inevitably advances—often at a rapid pace. Without this, we are concerned that any parameter-based controls will ultimately backfire, hurting US industry and leading to US dependence on foreign technology.

Additionally, it's important to note that manufacturers are mostly unwilling to put competition-sensitive information about specifics of their 5-year development roadmap into the public record, so this information likely needs to be inferred from other sources; e.g., based on prior trends, publications, patents, etc.

Proposed Parameter B: Binoculars, binoculars, monoculars, googles or head or helmet-mounted imaging systems

As explained earlier in this comment to the USML NOI, terms such as "binoculars," "bioculars," "monoculars" and "goggles" are potentially ambiguous and might be construed to include any camera

[2] See, for example, http://www.flir.com/ogi/content/?id=66693.

[3] See https://www.scottsafety.com/en/us/Pages/NewsDetails.aspx?Code=Scott+Unveils+In-Mask+Thermal+Imager+at+FDIC+2016!.

[4] **Exhibit B**: Moverio Lepton brochure showing Epson Moverio AR glasses integrated with FLIR Lepton IR module.

with an eyepiece, of which there are numerous examples in commercial use, including models with laser pointers which would potentially be captured by B(v).[5] In addition, the recent emergence of VR/AR display goggles and fire-fighting helmets integrated with very small, inexpensive IR modules (see previously noted examples) indicates it is very likely there will be a wide array of commercial applications emerging in the next five years. It is also very likely at least some will include a laser pointer and/or illuminator and be impacted by B(v) and/or multiple small IR modules with fused outputs and be impacted by B(iii).[6] Numerous recent patents and patent applications show industry is actively working in this area and highlight commercial applications where products will likely emerge within the next five years.[7]

Proposed Parameters K-N & O-Q: Infrared Focal Plane Arrays

Foreign availability of near-infrared (NIR) and short wave infrared (SWIR) IRFPAs is well established and is also emerging in non-Wassenaar countries.[8]

Foreign availability of mid-wavelength (MWIR) and long-wavelength (LWIR) cooled, photon (non-thermal) IRFPAs is well established and is also emerging in non-Wassenaar countries.[9]

Proposed Parameters R – Microbolometer IRFPAs

Foreign availability of microbolometer IRFPAs is well established and is also rapidly advancing in non-Wassenaar countries.[10] There is at least one 1024x768 14-micron pitch microbolometer manufactured in China that, already today, exceeds the performance parameters in (ii), so it is clear performance will be well beyond this level in the next five years.[11] Further, while "specially designed to withstand weapon shock" at first blush appears to be a reasonable criterion warranting tighter control, it doesn't negate the inherently dual-use nature of an IRFPA, and thus doesn't warrant controlling it as a munition on the USML. Some examples of matters related to ruggedness that were explored in depth in the process that led to the current regulation are worth reiterating:

1. Many civil/commercial IR camera systems have rigorous ruggedness requirements that require the IRFPA to also be rugged. Firefighting cameras must work in very harsh environments and are designed to survive very rough handling. Many portable thermography cameras for industrial applications are specified to survive a two-meter drop. Thermal scopes for civilian hunting/sporting applications are also emerging.
2. What happens if/when an IRFPA that wasn't specially designed for weapon shock happens to be rugged enough to withstand it? Would the manufacturers of IRFPAs need to test their existing and/or new designs to prove they cannot survive a weapon shock specification? Who has the burden of proof and what level of testing and analysis is sufficient? What equipment is needed to do the testing? What if some units of a particular model survive and some units fail due to

[5] See, for example, http://en-us.fluke.com/products/infrared-cameras/tix1000-infrared-camera.html
[6] See pending US patent application publication 20140139643 (available at http://patft.uspto.gov/)
[7] See pending US patent application publication 20150085133 (available at http://patft.uspto.gov/)
[8] **Exhibit C**: A recent Ghopto brochure picked up at the CIOE show in Shenzhen, Sept 2016, shows SWIR FPAs made in China.
[9] **Exhibit D**: A recent GuideIR brochure picked up at the CIOE show in Shenzhen, Sept 2016, shows MWIR and LWIR cooled photon (non-thermal) detector capability.
[10] **Exhibit E**: Dali Uncooled FPA Detector brochure. **Exhibit F**: Dali Technology Corporate Overview. **Exhibit G**: Norinco Group product brochure. See also **Exhibits A C, and D**.
[11] **Exhibit H**: A recent iRay brochure picked up at the CIOE show in Shenzhen, Sept 2016, shows the 1024x768 14-micron pitch microbolometer IRFPA.

normal manufacturing variation? Would assuring a model doesn't pass the weapon shock test make it less rugged and potentially less competitive than competing outside-the-US ("OUS") models that don't face this requirement? This would be especially troublesome in applications where ruggedness is a perceived advantage.

Proposed Parameter S: IRFPAs specially designed to provide distinct outputs corresponding to more than one spectral band

There are numerous civil/commercial applications for multispectral and hyperspectral imaging—it is not the exclusive domain of the military.[12] As such, IRFPAs that are suited for these applications are still inherently dual-use and so should be classified on the EAR, not the USML. Further, the terms "multispectral band" and "distinct output" are much too vague and don't convey any unique military (vs civil/commercial) capability. A quick search of USPTO published patents and applications shows there is a wide array of technical approaches used to achieve multispectral IRFPAs, many of which also cite civil/commercial applications.[13] In our view, finding a bright line to separate these approaches along military vs civil/commercial lines via technical parameters will be very challenging, if not impossible.

Proposed Parameter U: Analog readout integrated circuits

This appears redundant and/or needs clarification as ***all*** IRFPA ROICs "specially designed for articles in this subchapter" are already controlled via USML XII(e)(14). The clarification should address whether the proposal intent is to expand it beyond IR to all analog ROICs for any waveband (e.g., UV, visible, x-ray, THz, etc.), or narrow it to only those IRFPA ROICs with analog outputs.

Proposed Parameter V: Digital readout integrated circuits

IRFPAs with digital ROICs are becoming increasingly common for both military and civil/commercial applications. By itself, the presence or absence of a digital readout has nothing to do with the utility of an IRFPA for military vs civil/commercial applications (they're still dual use). Beyond this, there are several problems with the technical parameters in this specific proposal:

1. The technical parameter of "dynamic range" in (i) is not very appropriate for a ROICs by itself; at minimum, it needs further clarification in order to assess its applicability. The dynamic range of an *IRFPA* is determined from its minimum and maximum detectable IR signals and is ***dependent on both the ROIC and the sensor pixels integrated onto it***. Even if a particular ROIC/IRFPA combo fails to achieve some level of dynamic range (e.g. 54 dB) with a particular choice of sensor/pixel material, it would be difficult (impossible?) to prove the same ROIC cannot achieve greater than that with another sensor/pixel (e.g. one with improved S/N and/or non-linear response).
2. IRFPA dynamic range has nothing to do with utility of an IRFPA for military vs. civil/commercial applications—better dynamic range is useful for both. IR cameras used for firefighting and thermography are examples of civil/commercial applications that require and benefit from high dynamic range. A recent patent application focused on a digital ROIC design that can enable improved dynamic range—filed by a company that appears to be exclusively focused on civil/commercial applications—reinforces this.[14]

[12] Many good examples are illustrated at http://telops.com/markets-applications.
[13] See for example US patent 7,145,143 or published applications 20150316473, 20110242328, 20110176577, 20100276595, 20030160172, 20030132386 (available at http://patft.uspto.gov/ or https://www.google.com/?tbm=pts&hl=en).
[14] See pending US patent application publication 20150350567 by SeeK Thermal (http://www.thermal.com/).

3. The proposed dynamic range limit of 54 dB does not represent a high level of performance; it would capture presently available IRFPAs that are currently used in civil/commercial products. In general, it requires only 9 bits of digital resolution to achieve 54dB[15], while typical, digital-readout IRFPAs *available today* offer between 12-16 bits of digital resolution. Typical civil/commercial Fluke thermography cameras use IRFPAs with digital readouts that readily achieve dynamic range greater than 66 dB within a single image frame.[16]
4. Like dynamic range, pixel readout rate, as cited in (ii), is another example of a parameter that is equally important for military and civil/commercial applications (i.e., it conveys dual-use benefit). The pixel readout rate is calculated from the product of number pixels, frame rate and digital output bid depth, and thus it naturally scales upward as IRFPAs move to larger formats. Non-US IRFPAs makers already offer IRFPAs with readout rates greater than 100 million bits per second[17] and are known to be developing IRFPAs with rates approaching 300 million bits per second (640x480, 16-bit, 60 Hz). Given the above and the pace of progress, it seems very likely that non-US IRFPA vendors will exceed 540 million bits per second within the next five years.[18]

The USML NOI seeks to put back in place a confusing performance parameter control structure, similar to the much objected to, first proposed rule for this category of controls. Specifically, as seen through the examples above, the USML NOI has the potential to (1) create a blurred line for jurisdictional analysis, classification, and sustainment; (2) be overly broad and ambiguous and thus capture civil/commercial items, and (3) not give proper consideration to the foreign availability of similar, or even more advanced, items. Fluke believes that the "specially designed" criteria is a much more clear and simple way to handle controls for the items listed.

Though clear bright lines through performance parameters was a goal of the ECR process, this has proven difficult for some of the items listed in category XII, especially while maintaining the other ECR principles of clarity, simplicity and limiting the USML to the "crown jewels" of the military. Moreover, we do not feel that the parameters listed in this USML NOI are descriptors unique to the military. This is key to ensuring that commercial items are not caught on the USML today, or in the near future.

II. EAR NOI

The EAR NOI seeks to put back in place additional license requirements and remove licenses exceptions, similar to the first proposed rule for this category of controls. We feel that over control at any level does not benefit the US economy, our academic institutions or national security. Wide foreign availability of technology, many proposed in this NOI, means that strict controls are not warranted, especially the suggested addition of a license requirement for Canada.

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[15] For a linear signal with noise below 1 LSB (https://en.wikipedia.org/wiki/Dynamic_range). In fact, with a nonlinear sensor and/or signal conditioning, 54 dB can be achieved with even fewer bits.

[16] Typical Fluke IR thermography cameras have an IRFPA operating mode ("range 1") where they achieve NETD of less than 50 mK and scene temperature range of -20 to 80 C, so the "dynamic range" of this operating mode is 20 * log10(100/0.05) >= 66 dB. In fact, the cameras typically have two or three ranges using different gain and/or offset setting for the IRFPA and are able to measure temperatures up to 1200 C and well below -20 C, which leads to a camera system "dynamic range" of 20 * log10(1200/0.05) >= 87 dB. It is also well known to create high dynamic range ("HDR") images by quickly switching an FPA gain frame by frame (see, for example, US patent 7,336,823 available at http://patft.uspto.gov/ or https://www.google.com/?tbm=pts&hl=en). All of these are accomplished with typical IRFPA ROICs used in civil/commercial applications.

[17] See pp. 10-11 of the GuideIR brochure (**Exhibit D**) and the Ghopto brochure (**Exhibit C**). Also, ULIS and NEC are known to have IRFPAs with digital readouts (https://www.ulis-ir.com/media/catalog/datasheet/pico384gen2.pdf).

[18] A 1024x768, 16-bit, 60 Hz IRFPA would require 755 million bits per second (without compression)

a. De Minimis US Content for 0A919 Foreign Military Commodities

This proposed control does not impact Fluke directly. However, Fluke questions the feasibility of control, the complexity of the rule and the treatment of these items in a stricter fashion than 0A919 items that incorporate purely military items subject to the EAR (600 series items).

b. License Exception STA for Certain Night Vision Equipment To Be Embedded

To our knowledge, Fluke's cameras are not incorporated into higher level assemblies or systems. Therefore, this proposal has little if any impact on Fluke. However, Fluke questions if conditioning the use of license exception STA on end-use is a workable solution.

c. 6A993

Adding a license requirement for the export, reexport, or in-country transfer to or in a D:5 country for 6A993 items to be incorporated into a higher level assembly, equipment, or system, as described in the proposal, directly impacts Fluke's China service organization. Currently, Fluke ships our camera cores under 6A993 as no license required to our subsidiary in China for replacement into certain 6A993 9Hz thermal imaging commercial cameras. These thermal imaging cameras are purchased and used for generic civil purposes such as: inspection of buildings for improperly installed or missing insulation, defective seals on doors and windows, and problems with HVAC installations. The EAR NOI would impose a license requirement on Fluke for these transactions, which would be a significant and unnecessary hindrance to Fluke's strategic move to off-shore service center of certain thermal imaging cameras. More specifically, we have the following concerns with this proposed change.

Fluke's administrative burden was significantly increased in regards to 6A993 items after the October 2016 EAR revisions to 744.9, including the creation and implementation of new processes, forms, training, and audits internally and with all of our global subsidiaries and channel partners. The EAR NOI will further inflate this problem. Putting a license requirement on these 6A993 items will be an overwhelming administrative/resource burden to implement proper controls, especially with inventory tracking and MOFCOM requirements. The increased administrative hurdles will cause significant delays with our China thermal imaging service line, thus putting Fluke at a further disadvantage against our foreign competitors.

Further, we think this proposed license requirement is overly broad and should be eliminated or at most, restricted to incorporation into a higher level assembly, equipment, or system for a military application. We also question the need for this license requirement when, in many cases, the de minimis rule and military end-use rules of 744.9 and 744.21 already restrict transfers to military end-users and for military end-uses. Expanding this restriction, from our perspective, would only impact commercial transactions that otherwise do not require any license and would put Fluke at a severe competitive disadvantage.

Additionally, this proposed requirement does not take into account the foreign availability of these types of cores. The domestic thermal core market in China is growing rapidly and cores greater than 9Hz are widely available.[19] This proposed control is far from aligned with EU and Wassenaar controls which puts US core suppliers at a competitive disadvantage against foreign competitors.

[19] See for example Guide Infrared's thermcores and components at http://guideinfrared.com/Plus/m_default/Cms/docList.php?ID=76.

Finally, it is unclear from how the proposed change is written if the higher level assembly, equipment, or system (i.e., finished product with the incorporated 6A993 item) would require a license for re-export or in-country transfer. If so, an in-country transfer license for these finished low end cameras would completely destroy Fluke's strategic service line in China, placing Fluke again, at a greater competitive disadvantage. Thermography cameras at this level are widely available and found throughout China, both domestically and foreign produced. Exhibit I is a foreign availability sampling of 6A993 and 6A003 cameras.[20] These cameras compete with Fluke's products, are manufactured outside of the U.S., are not subject to U.S. export controls and, to the best of Fluke's knowledge, are widely available throughout the world key. Highlights include:

- There are at least two dozen companies selling thermal imaging cameras, located in over a dozen countries.
- Competitive products are available in a wide range models with bandwidth ranging from 80x60 to 2048x1536 and frame rate from 9 Hz to 240 Hz.
- There are over twenty competitive 9 Hz camera models (6A993) manufactured in at least 8 different countries.
- There are over forty competitive cameras over 9Hz (30-240 Hz) (6A003).
- There are at least four brands in China with products ranging from 80x80 to 640x480 and 9 to 60 Hz.

d. Supplement No 1 to Part 774 – ECCN 3C001 & 3E001

This proposed control does not impact Fluke directly, but Fluke objects to additional unilateral controls that will most certainly place US industry at a competitive disadvantage. If these controls are required for national security reasons, the US should propose a multi-lateral control under the Wassenaar Arrangement. Additionally, as discussed above in detail, the foreign availability of thermal imaging technology is rapidly increasing in non-Wassenaar countries.

e. Supplement No 1 to Part 774 – ECCN 6E001, 6E002 and 6E990

Given the current state of thermal imaging research, development and manufacturing, which is now spread throughout the globe, Fluke does not support expansion of licensing for these ECCNs. While strong controls on certain components and development technology may be warranted, this proposal undermines the flexibility of EAR controls on commercial thermal imaging technology, and would negatively impact the competitiveness of U.S. industry by burdening its ability to work cooperatively with our closest allies.

The US and Canada thermography industries rely heavily upon each other for research, development, sourcing and manufacture of FPAs and ROICs. A license requirement for technology related to these components would severely hamper this mutually beneficial relationship.

In our experience Canadian companies intentionally avoid sourcing export controlled technology from the US fearing that the technology will taint their non-US sales as well. The result is that Canadian companies refuse to participate in partnerships with US companies. This will not only impede our ability to source components from Canada, but will put the US industry at a competitive disadvantage.

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[20] **Exhibit I**: Foreign availability chart created by Fluke Corp. Data provided for the most part is publically available information. In some cases (when data was not publically available), data provided is based on Fluke's knowledge of the industry or best estimates, and may not be 100% accurate. If Country of Origin data was not publically available, Fluke provided the best known location of the company headquarters.

Furthermore, as discussed extensively, the foreign availability of these technologies is well established. A global license requirement will not improve the US national security.

III. CONCLUSIONS

Overall, Fluke believes that these NOI proposals, like proposals of the past, are fundamentally flawed, which undermine the policy objectives of ECR, and the objectives of the U.S. export control regime in general. The overall effect of these controls will likely be to reduce the competitiveness of U.S. industry, sheltering foreign competitors and enabling them to gain a greater share of the commercial and military markets. This may lead to increased costs for the U.S. government, potential loss of U.S. technological edge, and ultimately to greater U.S. government reliance on foreign-sourced thermal imaging commodities. Fastening the export control tethers too tightly, without regard to existing foreign availability and the intertwined relationship between a healthy U.S. commercial thermal imaging industry and a healthy U.S. military industry, may unintentionally transform those tethers into a noose, choking off a key source of important tactical technology for the U.S. government, while simultaneously pushing good U.S. jobs offshore to foreign competition.

Overall, Fluke would like to see the regulations for Category XII of the USML and Category VI of the CCL remain as written, and wait for further evaluation of potential changes after the current regulations have been in place for 18 months to two years.

Thank you once again for the opportunity to provide comments to these NOI proposals. We would be pleased to discuss any of this with BIS.

Submitted on Behalf of Fluke Corporation by,

Matthew Schmidt, Director, Business & Technology Development

Jennifer Christy, Senior Manager, Trade Compliance

Slone Pearson, International Trade Compliance Counsel

Sharron Cook

From: IRP Technology/Jack Lovell <jackl@irptechnology.com>
Sent: Tuesday, February 28, 2017 2:35 PM
To: PublicComments
Subject: RIN 0694-XC035 - regulations for Category VI of the CCL remain as written

Regulatory Policy Division

Bureau of Industry and Security

U.S. Department of Commerce

14th Street and Pennsylvania Ave., N.W.

Room 2099B

Washington, D.C. 20230

Subject: BIS Notice of Inquiry, RIN 0694-XC035

To Whom It May Concern:

Thank you for this opportunity to comment regarding potential changes to the recently finalized Category VI of the Commerce Control List.

As a company, we would like to see the regulations for Category VI of the CCL remain as written, and wait for further evaluation of potential changes after the current regulations have been in place for 18 months to two years.

Once again, this NOI seeks to put back in place additional license requirements and remove licenses exceptions, similar to the first proposed rule for this category of controls. We feel that over control at any level does not benefit the US economy, our academic institutions or national security. Wide foreign availability of technology, many listed in this NOI, means that strict controls are not warranted, especially the suggested addition of a license requirement for Canada.

Thank you again for this opportunity to comment.

Sincerely,

Jack Lovell

CEO

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March 14, 2017

Regulatory Policy Division
Bureau of Industry and Security
U.S. Department of Commerce
14th Street and Pennsylvania Ave., N.W.
Room 2099B
Washington, D.C. 20230

Subject: BIS Notice of Inquiry, RIN 0694-XC035

To Whom It May Concern:

Lakewood Technologies LLC (LWT) is a consulting firm which provides export strategy advice related to sensors and lasers controlled under EAR ECCN 6 and Category XII of the ITAR. Additionally, I am the current Chairman for the BIS Sensors and Instrumentation Technical Advisory Committee (SITAC) and in the that role have been very involved with the first two proposed rules for Category XII and the BIS Companion Rules. LWT is pleased to provide comments regarding the Notice of Inquiry (NOI) referenced in the subject line.

Introduction

The BIS NOI was created in conjunction with the State Department NOI and was apparently developed in order to accommodate last minute issues raised by an un-named US Government agency.

The timing of this NOI is very frustrating for industry considering the significant amount of time that has been spent by both industry and the US Government on reviewing the ITAR Category XII and the BIS Companion Rules. BIS and the State Department issued Federal Register Notifications on May 5, 2015 after having inter-agency discussions related to Export Control Reform (ECR) about these regulations since the Spring of 2010. There was an over-whelming negative response during the Public Comment process (120 separate comments to State and 60 comments to BIS) that resulted in a complete re-write of the Category XII and BIS Companion Rules. The second proposed rule was published on February 19, 2016 which described parameters that all parties agreed could work. *The majority of the public comments stated that the proposed controls in USML Category XII drew a clear line between the USML and CCL for items that are exclusively military vice those that have commercial and civil applications.* The final rule was published on October 12, 2016

with an effective date of December 31, 2016, after eight (8) months of review by the USG. Industry, Universities and other US government agencies applauded State, BIS, DOD, Homeland Security and others for having collaborated and finally found that "bright line" to describe Military Items and technology.

The publishing of the NOI in January 2017 to re-open the discussion does not make sense and points to a rule-making process that is broken.

Many of the parameters in the State Department NOI are just at the edge of today's advanced technology. However, there is no established process for reviewing technology parameters in the future as technology advances and foreign availability continues to advance. The "specially designed" regulation was incorporated into much of the Category XII re-write to address the fact that sensors and lasers are not inherently military technology unless uniquely designed and manufactured to be integrated into military systems. As mentioned above, State, Commerce, Defense, Homeland Security and other US Government agencies wrestled with developing "military" performance parameters for over half a decade during the Export Control Reform (ECR) review of Category XII. The timing of this NOI is greatly out of sync with the Category XII review process that started around 2010 and ended on December 31, 2016 with the publishing of the new rules. The tardiness of these new parameters are disruptive to the USG as it works to implement the new regulations and very confusing and costly to industry as it struggles to interpret the regulations and develop compliance programs that support business plans related to revenues, R&D investment, competition, and the creation of US jobs. These proposed parameters will weaken US industry's ability to compete globally against a strong and growing international infrared supplier manufacturing base. US National Security will be jeopardized if US industry is restricted from competing globally on a level playing field which will ultimately impact the amount of resources US industry invests into research and development. The proposed NOIs do not support US Industry nor protect US National Security in a positive manner.

Industry expended significant effort to respond to the May 2015 and February 2016 rules and frankly, it's difficult to rally industry to respond for a 3rd time to issues that have already been well documented in the previous two public comment sessions. Many in industry have lost faith in this rule making process, believe that it will never end, and won't be surprised if another arcane policy is dusted-off to present yet another hurdle.

Comments

Section 734.4 "De Minimis U.S. Content" for 0A919 Foreign Military Commodities

The proposed change to this section will place stricter treatment of 0A919 containing dual-use items (including items previously controlled only for National Security [NS-1]) than 0A919 items incorporating purely military content subject to

the EAR (600 series items). This is a significant increase in export controls of US origin products that are widely available world-wide.[1] Additionally, the parameters listed do not describe military items. In fact, the parameter (75,000 pixels) for the Focal Plane Array (FPA) and the Readout Integrated Circuit (ROIC) is very old technology. Much larger arrays than 320x240 are produced world-wide, including China. Reference footnote 1 for extensive foreign availability data.

Section 740.20. License Exception Strategic Trade Authorization (STA) for Certain Night Vision Equipment to be Embedded

Restricting use of STA for cameras to be embedded will have a negative impact on US industry's ability to compete globally. The language is confusing as there are many types of cameras at various stages of assembly that are embedded. It's not clear the type of cameras that are intended to be controlled. The NOI language references "kits, cores, modules" however, previous Public Comments discussed in detail that it was not possible to accurately describe the difference between a "core" and a "camera". This language could also restrict the integration of a camera that will be embedded into a commercial security system purchased by homeowners, or a camera embedded into a Thermography camera, or into a commercial navigation system used for yachts. The definition of "camera" is clearly identified in the EAR and the ITAR and are identical. Please reference footnote 1 for extensive discussion about the definition of camera, the foreign availability of camera cores, and of the challenges of distinguishing embedding cameras into commercial versus military systems.

ECCN 6A993

- This language is overkill considering the license requirement for 9 Hz cameras in §744.9.
- There is extensive foreign availability of this technology world-wide including China. Reference footnote 1 for extensive data on foreign availability of technology that operates faster than 9Hz.
- Review of the data in footnote 1 demonstrates that this will put US industry at significant disadvantage.

ECCN 3C001 and 3E001

This potential revision adds a very restrictive license review process (worldwide except Canada) for III-V compounds of gallium or indium, and aluminum, antimony, or arsenic, forming a strained layer superlattice having a photoluminescence signal maximum originating from the superlattice in the wavelength range exceeding 3,000 nm but not exceeding 15,000 nm at a temperature less than 200 K.

[1] Public Comments to Federal Register Notification RIN 1400-AD32 (DDTC) and RIN 0694-AF32 (BIS)

This change will be a US unilateral change and it would seem that the first step is for a proposal to be sent to Wassenaar. This material is widely available outside of Wassenaar.

ECCNs 6E001, 6E002, and 6E990

This proposed revision adds a worldwide restrictive license review process (Regional Stability [RS] Controls) for specific technology related to focal plane arrays and ROICs. This restricts exports of products to Canada which would represent the only ECCN in the EAR that would require an export license to this destination. A similar proposal was included in the May 2015 proposal it received a very negative response from industry as well as the Canadian Government.

I strongly believe that this NOI is not a good use of the precious US Government resources, and it is very frustrating for industry to be required to re-hash discussions and resurrect data that was provided in the May 2015 and the February 2016 Public Comment process. I recommend that BIS and the State Department work to implement the December 31, 2016 rule and push aside this NOI process.

Thank you for the opportunity to comment on these matters of great importance to the US Thermal Imaging Industry. If you require any further information, please contact me at 503-810-8756 or via email at stevejtribble@gmail.com

Sincerely,

LAKEWOOD TECHNOLOGIES LLC

Steve Tribble

Nu-Trek, Inc.
16955 Via del Campo, Suite 250
San Diego, CA 92127
Phone: 858-487-0620

Response to Department of Commerce
Bureau of Industry and Security
Docket Nr. 170106032-7037-01
RIN 0694-XC035

ECCNs 6E001, 6E002 and 6E990 - (iii) 6E990 development and production technology for read-out integrated circuits specially designed for those focal plane arrays specified in ii, above (i.e., microbolometer infrared focal plane arrays controlled in 6A002.a.3.f and two-dimensional infrared focal plane arrays controlled in 6A002.a.3.c).

Almost without exception, ROICs are designed using commercial tools such as those supplied by Cadence Design Systems. These tools are used to design all types of integrated circuits and subsystems, and are sold and supported internationally. ROIC's represent a vanishingly small market for these tools (~20 ROIC design starts / year in the US) vs 1,000's of design starts in the broader integrated circuit design market, placing unique controls on these design tools will result in the tools being no longer being provided / supported for ROIC design – the market is just not worth the added risk and complexity of unique export controls.

Similarly, ROIC's are processed at commercial foundries that simultaneously fabricate large volumes of other products ranging from microcontrollers to memory to display controllers. The process flows used are not unique to ROIC's – indeed most foundries are reluctant to alter their standard process flows due to the difficulty of maintaining process control when running multiple recipes. ROIC's represent a miniscule percentage of the overall volume of integrated circuit wafers produced, to illustrate the point the largest producer of IR devices in the US (FLIR systems) procured 2,275 ROIC wafers for uncooled production in 2016, adding in wafers for cooled product grows the total to just under 3,000 wafers. Per MAXTECH FLIR enjoys approximately 55% of the world market for uncooled devices, assuming that all wafers are produced in the US, 3,000 wafers represent 55% of 5,455 wafers in 2016. Looking at figures compiled by the Semiconductor Industry Association for 2011 (the last set of data that was freely available), industry had an average capacity of 1,849,400 wafer starts per week, or an annual capacity of 96,168,800 wafers per year – in 2011 the world was emerging from recession and capacity has been added since then. Putting ROIC's in that context, ROIC fabrication represents 0.006% of the silicon industry's integrated circuit wafer capacity. Placing unique controls on either the processes used to fabricate ROIC's, or the wafers themselves will result in foundries refusing the work, the market is just not worth the added risk and complexity to comply with unique export controls.

However well-intentioned the proposed controls are, it is expected that they will have the effect of curtailing if not outright ending the design and fabrication of ROIC's in the US. Looking to

the future, for a variety of reasons foundries offering advanced processes (such as feature sizes below 90nm) are increasingly located overseas – primarily in Asia. By placing controls on ROIC designs, US developers of advanced IR focal plane arrays are blocked from accessing these advanced processes, while our foreign competitors are not. This will result in the designs developed by US based companies becoming increasingly obsolete while more advanced designs become available to potential adversaries.

So, what controls might be workable? Focus on aspects of ROICs that do not have a heavy dual use component and provide a uniquely military advantage. Examples might include:

- Processes specifically developed for radiation hardness
- ROIC designs that provide a unique military function, such as imaging in a gamma debris environment
- Custom models and S/W specifically developed for military designs

(ii) 6E001 development technology or 6E002 production technology for microbolometer infrared focal plane arrays controlled in 6A002.a.3.f and two-dimensional infrared focal plane arrays controlled in 6A002.a.3.c.

Presently the two most advanced / lowest cost microbolometer fabrication lines are integrated into existing commercial silicon wafer fabs. By doing so, much of the cost of operating a wafer fabrication line is amortized over a large volume of commercial products. This strategy was made possible by adapting the microbolometer design to a large degree to the existing processes in place in these facilities. These processes (thin film deposition, photo patterning, etch) are well covered in the open literature, and benefit from a large body of existing experience and trained personnel to execute and control the processes and maintain the equipment. To now place unique controls on these processes because they are used on microbolometers will break this business model, which is critical to the US being able to compete in the marketplace. As a result, microbolometer production in the US will return to "boutique" production lines, which produce low volumes at high cost, with their only customer being the US DOD. High volume commercial production will shift to overseas locations not hampered by US controls, this technology will proliferate and become available to potential adversaries at a lower cost than that paid by the US military.

So, what controls might be workable? Focus on aspects of the production flow which are unique to microbolometers or IR detectors such as:

- Equipment for VOx deposition
- Recipes for VOx deposition
- Non-standard processes used for IR FPAs, such as indium bump deposition. This would need to be carefully tailored to avoid picking up commercial interconnect technologies such as ball grid arrays or 3D integration.

BIS also requests comments on how this potential change would affect the U.S.- Canada trade and defense relationship and whether this potential revision would further the collective North American security.

These rules will result in more of the development and manufacture of ROIC's and IRFPAs shifting outside of the continental US, either to Canada or to Asia. This will contribute to the proliferation of this technology from sources where the US has even less visibility than US suppliers. Thus, US forces may become aware of the proliferated technology when they encounter it on a battlefield, which is hardly an enhancement of the collective North American security.

Increase of Controls: Infrared Detection Systems

Docket No. 170106032-7037-01
RIN. 0694-XC03

Qioptiq Ltd (QUK) appreciates the opportunity to comment on the proposed control changes to Infrared Detection Systems as described within Federal Notice Register 82 FR 4287.

Background

QUK are a designer and manufacturer of electro-mechanical optical modules for defense and commercial applications. Its portfolio of products and technology includes Avionic head up displays and helmet mounted systems. Night vision (thermal and NIR) for soldier/vehicle systems, target surveillance and acquisition systems. Space optics for satellites.

Scope: Section 734.4 "De Minimis U.S Content" for OA919 Foreign Military Commodities.

Qioptiq regularly purchases US designed and manufactured Thermal cameras controlled by 6A003 b.4.b and incorporate these within night vision equipment controlled by 0A919.

As of December 31, 2016 final rule broadened the scope of ECCN 0A919 to include incorporated infrared detection items in ECCN's 6A002, 6A003, 6A990, or 6A993.a (having a maximum frame rate equal to or less than 9Hz and thus meeting criterion of note 3.a to 6A003 b.4) and limited the destinations subject to no de minimis provision to Group D:5 countries.

This was seen as a positive move by the US Government to generate export sales for US Companies, by removing some of the inhibitors to foreign companies to select US technology within their designs and products. Qioptiq regularly reviews its product development plans based upon the availability of technology worldwide and the various export limitations that may apply. Irrespective of Qioptiq decisions many customers still demand products free of US controlled technology and hardware.

The proposed revision seeks to expand the destinations subject to the no de minimis provision to "any destination, except Canada" based upon certain parameters being exceeded. Eg: an infrared focal plane array (FPA) with format exceeding 75,000 detector elements. This will capture all the thermal cameras currently sourced by Qioptiq from the US within the no de minimis provision, Qioptiq typically source FPA's with a minimum of 76,800 (320 x 240 camera). In addition, these restrictions also apply to 9Hz cameras (ECCN 6A993).

Qioptiq understands the need for appropriate export control of technology and hardware but regardless of the US licensing requirements all Qioptiq exports are also managed in accordance with the UK export control regulations.

Availability of non US Thermal Camera technology

There are many non US sources for FPA's that compete with and exceed the performance of US controlled hardware. These are offered for consideration when determining the appropriate controls for US technology and the impact they may have on the competitiveness of US manufacturers and suppliers.

Thermoteknix (UK)-

http://www.thermoteknix.com/wp-content/uploads/2015/04/MicroCAM-3-Brochure.pdf

Tonbo Imaging (India)-

http://tonboimaging.com/tonbo/products/hawkvision/

DST Control (Sweden)-

http://www.dst.se/documents/SAITIS-2-640.pdf

Xenics (Belgium)-

http://www.xenics.com/en

Other sourcing options include:

China - http://en.iraytek.com.cn/index.php?m=content&c=index&a=lists&catid=51

Turkey - http://www.mikro-tasarim.com.tr/products

Due to US licensing restrictions Qioptiq continue to develop non ITAR/EAR night vision equipment. Product data sheet attached for SAKER-E with submission.

Proposals

Ref: No De minimis provision.

Accepting a certain level of control is necessary this proposal is based upon performance and end use territory.

Suggest two levels -

40% De minimis
ECCN 0A919 to include incorporated infrared detection items in ECCN's 6A002, 6A003, 6A990, or 6A993.a (having a maximum frame rate equal to or less than 9Hz and thus meeting criterion of note 3.a to 6A003 b.4 & not exceeding 77,000 detector elements) and limited the destinations subject to no de minimis provision to all groups except A1 & A2 countries.

25% De minimis
ECCN 0A919 to include incorporated infrared detection items in ECCN's 6A002, 6A003, 6A990, or 6A993.a (having a maximum frame rate equal to or less than 9Hz and thus meeting criterion of note 3.a to 6A003 b.4 & not exceeding 310,000 detector elements) and limited the destinations subject to no de minimis provision to all groups except A1countries.

This level of control would release some cameras and territories from US licensing requirements, broadly in line with destinations that would be approved if license applications were submitted. Other territories would still require US Government approval.

Dave Widdows
Director Compliance (UK)
Qioptiq Ltd

QIOPTIQ
Photonics for Innovation
An Excelitas Technologies Company

SAKER-E

Optically Blended Weapon Sight
Uncooled Thermal Imager / Image Intensifier

SAKER-E is the new Dual Channel Weapon Sight product development from Qioptiq providing the Dismounted Close Combat User with an enhanced, dual waveband Detect, Recognise & Identify capability.

SAKER-E is a fully qualified military Weapon Sight designed specifically for short and medium range surveillance and target engagement.

SAKER-E attaches to Picatinny style rails in front of the day sight via a quick release throw lever, providing 24hr capability without the need to remove or re-zero the day sight.

SAKER-E combines the latest Image Intensification and uncooled Thermal Imaging capability in a single lightweight, compact yet rugged package.

SAKER-Es 17µm, 60Hz uncooled thermal sensor delivers class leading sensitivity, uniformity and system latency in an ITAR free package.

SAKER-Es Thermal Imaging system is nested within the obscuration of the catadioptric Image Intensifier lens, providing a zero parallax solution whilst maintaining the benefits of dedicated channels.

SAKER-E

Technical Data

Thermal Imager

Sensor: 17um, 60 Hz (a-Si) (European)
Field Of View: 10.2° x 7.7°
Focal Length: 30.4mm
Aperture: F/1
Focus Range 30m to ∞ (fixed focus)
Diamond Like Carbon (DLC) Anti-Reflection optical coating

Image Intensifier

Field of View: 10° circular
Focal Length: 67mm
Aperture: F/1.05 (F/1.6 effective)
Focus Range: 15m to ∞
Durable Anti-Reflection optical coating

Image Intensifier Tube:
18mm format
SAKER-E can be fitted with a range of standard and auto-gated
ITAR and Non-ITAR tube variants.

Display

Type: OLED, full colour, 800 x 600

Magnification

x1

Controls and Functionality

Modes: Off / I^2 / Blend / TI / Menu

Functionality: Blend Adjust, Brightness, Polarity, NUC, Outline, Edge, Aiming Mark.

I/O Port

RS232 Comms, External Power, Video Out (PAL/NTSC)
Standard: TI Video Out
Optional: Blended video out

Power

3 x 1.5v AA Cells
Polarity Protection
>7.1hrs continuous operation, Blend Mode
>60hrs continuous operation, I^2 Mode

Nominal dimensions:

189mm (L) x 84mm (W) x 75mm (H)
950g - Includes:
SAKER-E Weapon Sight, picatinny style rail grabber (single throw lever, no adjustment required)
3 x AA Lithium Cells, lens cap and light security shroud.

Finish:

Various paint options available

Environmental

DEF Stan 00-35 Part 3 (Environmental)

Temperature (Operating)
Temperature (Storage)
Thermal Shock
Solar Radiation
Shock – Drop Test (Sight Alone, Field Pouch and Logistical)
Shock – Vibration (Fixed Wing Propeller, Rotary Wing, Tracked and Wheeled Vehicle)
Low Air Pressure and Transportation
Chemical and Biological (Resistance and Decontamination)
Dust and Sand (Wind Blown)
Water Immersion (20m)
Driving Rain
Mist, Fog and Low Cloud
Salt Atmosphere
Mould Growth

DEF Stan 08-41 Part 1/1 (Chemical and Biological)

Chemical and Biological Hardening
Decontamination – In Service decontaminants

Tube:
18mm format
SAKER-E can be fitted with a range of standard and auto-gated
ITAR and Non-ITAR tube variants.

DEF Stan 59-411 Part 3 (Electro-Magnetic Effects)

Electro Magnetic Compatibility – Emissions and Susceptibility

Package

Standard

SAKER-E Weapon Sight
Lens Cap and Light Secure Shroud
Transportation Case and Field Pouch
Operators Manual
Lens Cleaning Kit
3 x AA Lithium Cells

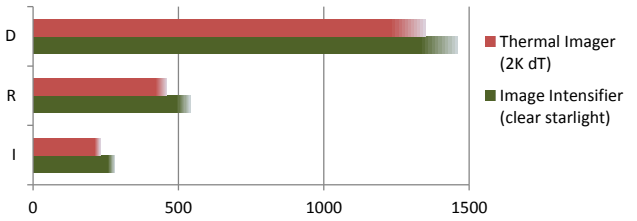
Options

6 Function Remote Control
Blended Video Output
Daylight Training Filter

Range Performance

Detect Recognise Identify

1.8 x 0.5m target, 50% probability, x4 magnification



Thermal / Image Intensified Blend

Reduced Thermal Blend

Thermal Outline Blend

Contact:
sales@uk.qioptiq.com |
Telephone: +44(0)1745 588000
Qioptiq Ltd. | Glascoed Road | St. Asaph | Denbighshire | LL17 0LL | United Kingdom
www.qioptiq.com

March 14, 2017

Via: www.regulations.gov

Regulations.gov ID: BIS-2017-0001
RIN 0694-XC035

Attn: Christopher Costanzo
U.S. Department of Commerce
Bureau of Industry and Security
Christopher.Costanzo@bis.doc.gov
(202) 482-0718

Subject: Raytheon Company Comments on BIS Infrared Detection Items

82 Fed. Reg. 4287 (January 13, 2017)

On October 12, 2016, Department of Commerce ("Commerce" or "the Department"), Bureau of Industry and Security ("BIS"), published a final rule related to certain fire control, laser, imaging, and guidance equipment. Subsequently, on January 13, 2017, BIS requested comments from the public on the impact of further increasing certain controls implemented by that final rule.

Comments in response to Commerce's inquiry must be submitted by March 14, 2017. Below please find comments from Raytheon regarding this Federal Register Notice.

I. INTRODUCTION

BIS has requested public comments on the effect additional license requirements for Infrared Detection Items would have on:

- the national security or foreign policy interests of the United States;
- the export performance of the United States;
- the competitive position of the United States in the international economy;
- the international reputation of the United States as a supplier of goods and technology; or
- the economic well-being of individual United States companies.

Below Raytheon provides comments regarding the impacts of these requirements on industry.

II. LICENSE EXEMPTIONS

A. *De Minimis* U.S. Content for 0A919 Foreign Military Commodities

BIS proposes the elimination of the *de minimis* U.S. content licensing exemption for all countries other than Canada, for the following items:

> Non-U.S. military commodities (0A919) that incorporate:
>
> (1) Image intensifier tubes having a figure of merit (FOM) exceeding 1,400 lp/mm; (2) an infrared focal plane array (FPA) with format exceeding 75,000 detector elements; *or* (3) related infrared focal plane array read-out integrated circuit having more than 75,000 unit cells.
>
> FOM would be defined as the product of the tube's signal to noise ratio (SNR) and limiting resolution (FOM = SNR (unitless) × Limiting Resolution (lp/mm) and is a term of art regularly associated with exports of image intensifier tubes and related devices subject to the ITAR.

Currently, the *de minimus* exemption is permitted for exports to all countries other than the D:5 embargoed countries.[1] Therefore, this change would greatly expand the licensing requirements for the products identified above.

Impact to Raytheon of More Stringent Licensing on ECCN 0A919

Raytheon believes additional license requirements on these commercial products may put U.S. manufacturers at a competitive disadvantage throughout the supply chain for these products. First, it appears a number of input products would be subject to licensing requirements for the first time as they would cause the end product to require U.S. licenses. Second, these products include certain low-level technologies that are already readily available from foreign manufacturers. For example, the parameters described in 0A919 and in the Department's notice include a variety of products that are used by the U.S. Park Service, various search and rescue authorities, and for basic scopes on hunting rifles. One example is the "Thermal Weapon Sights (320x256 bolometer (VOx or alpha Si)) and incorporated microbolometer core camera," which is currently on the commercial market.

[1] Prior to December 31, 2016, no *de minimis* exemption was available for ECCN 0A919 items ("military commodities located and produced outside the United States") that incorporated 6A003.b.4.b (imaging cameras incorporating certain focal plane arrays). As part of the ECR transition, a number of IR detection items were moved from the ITAR to EAR, including items in ECCNs 6A002, 6A003, and 6A990. The *de minimis* exemption for non-U.S.-made products still applied for these ECCN categories. However, on May 5, 2015, BIS removed the *de minimis* exemption for several of those categories. BIS subsequently relaxed the restrictions, by determining that the "no *de minimis*" rule would apply only to exports/re-exports to D:5 (embargoed) countries.

See, e.g., http://www.flir.com/cores/display/?id=51981. Indeed, this technology is from the 1960's and it is so dated that even the U.S. government no longer uses it. In addition, commercial QVGA displays exceeding 75,000 detector elements (320x240) are currently used in cell phones, cameras, and commercial industry monitoring and measurement tools. *See, e.g.,* http://www.thermal.com/products/compactpro/.

Therefore, these changing and increased restrictions substantially hinder the market for U.S. producers, as foreign downstream manufacturers can readily find the same products from non-U.S. suppliers. Indeed, Raytheon currently has foreign sales of FPAs in foreign markets that would likely be hindered or cancelled altogether if this licensing process is imposed.

With the change, lower-level commercial technology products that were previously afforded the *de minimis* exemption are now grouped with prior USML items, and as a result are no longer eligible for the exemption. Further, as noted above, the technical descriptions of the input products (such as the "FPAs with format exceeding 75,000 detector elements)), also include dual-use products that are not currently subject to the licensing requirements.

This is especially true with items such as ROICs, that make up a small (*i.e.*, *de minimis*) portion of the overall cost for foreign producers. ROICs are used for a variety of commercial and dual use items, and may be designed specifically for items that fall within the above parameters, but are in fact dual use or commercial in nature. These ROICs are often produced in commercial foundries that manufacture multiple commercial and dual use ROICs for a variety of dual use end products. It would be more efficient for the foreign producers to purchase elsewhere than to impose extensive controls on their commercial products. As a result, U.S. manufacturers, such as Raytheon, could lose significant export business for products that are already on the market and do not warrant increased controls.

Impact on Competitive Advantage

The additional restrictions on the *de minimus* exemption would hinder U.S. companies' ability to sell inputs overseas and to benefit from a global supply chain that is not available in the United States. In particular, by requiring a license for exports of 320x240 uncooled FPAs, U.S. manufacturers will directly lose business to suppliers in France, Israel, Belarus, and China. This could also have significant negative impacts on future automotive applications that would use a 640x480 format. These input items represent significant business for U.S. companies but remain as low-cost items with low margins. As a result, in addition to the licensing burden, even just the cost of licensing could be prohibitive.

The original intent of ECR was to relax requirements for dual-use products that were overly controlled under the USML. However, restricting the *de minimus* exemption in

this instance would have the effect of sweeping in non-USML items and would substantially impact the competitiveness of U.S. companies. Therefore, Raytheon recommends the Department not implement this proposed amendment.

B. Strategic Trade Authorization ("STA") Exception

Raytheon reiterates the same concerns with respect to the proposed change to the STA exemption. The Department is now considering removing the STA eligibility for ECCN 6A003.b.4 that: (i) Are being exported to be embedded into a higher level assembly, system or equipment; and (ii) incorporate two dimensional FPAs specified in either ECCN 6A002.a.3.c or ECCN 6A002.a.3.f, and that have more than 328,000 detector elements. In essence, BIS is expanding the limits on night vision technology to 6A003.b.4, which previously was afforded STA benefits. In particular, this ECCN category (6A0023.b.4) existed prior to the transfer from the USML. As a result, certain items that were never included on the USML will now lose eligibility for the STA exemption under the CCL. Further, this has a significant impact on component suppliers for IR cameras subject to this category (such as QVGA displays noted above), as foreign producers may be more likely to purchase from non-U.S. suppliers to avoid the controls.

As noted above, this is contrary to the objectives of ECR. Also, we understand the Department is considering this review option as a way to monitor and track these items when incorporated into commercial or civil systems. We believe that the cost to U.S. producers far outweighs the benefits of monitoring these items that are already on the market. Therefore, we recommend BIS not move forward with this proposed change.

C. Specific ECCN Changes – 6E001, 6E002 and 6E990

Raytheon recommends against the proposed addition of Regional Stability ("RS") worldwide control with respect to components controlled under 6A002 and 6A990. In particular, increased controls on inputs for 6A002 and 6A990 will especially impact U.S. production and supply of ROICs, which are developed specifically for the items in question. It is helpful that BIS agreed not to impose the heightened restrictions on the *end products*. However, by restricting the technology, U.S. manufacturers of ROICs would need to drastically modify production procedures for standard commercial/dual use items, and could lose contracts with foundries and other suppliers who utilize foreign employees for their commercial production lines.

For example, the production of uncooled microbolometer technology involves utilizing equipment from Germany and elsewhere. These equipment suppliers and the foundries have employees from all over the world and would need to segregate their databases, equipment, materials, from those employees. In addition, even just the basic cost of licenses would be prohibitive for these standard low-cost commercial items. This

extensive process for a small percentage of business would likely cause those foreign purchasers (including those in Canada) to go to suppliers outside the United States.

U.S. industries have engaged in these types of partnerships for production of ROICs and other dual-use component inputs, to take advantage of economies of scale and shared production for purely commercial components that are used by both DoD and commercial/civil users. The U.S. government therefore benefits from stable product availability and lower input costs as a result of these production partnerships. We therefore, urge the Department to consider downstream implications when applying controls that could impact lower-level commercial inputs that do not require security reviews.

* * *

Low Cost Thermal Imaging Serves the US Military and Now, Goes Far, Far Beyond It. Keep it American

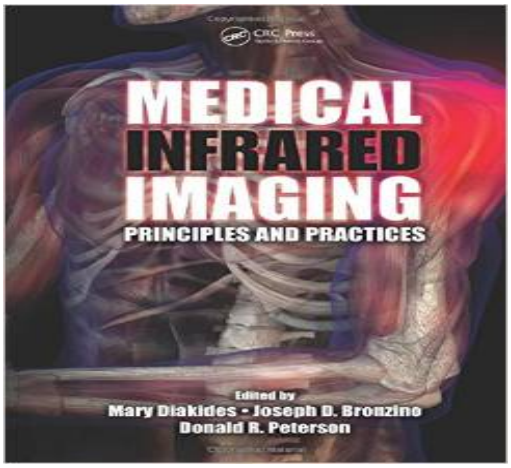
Microbolometer-based thermal sensors and imagers have joined a remarkable trio of other technologies – born from DoD sponsorship – that have transcended pure military applications and now serve mankind in an amazing number of ways. Low power, high resolution color liquid crystal displays, film-quality silicon imagers and GPS locators are everywhere. Once thought to be the unique tools of the US warfighters and intelligence communities, these technologies, built into a wide variety of portable commercial products, are today being carried by no small fraction of the world's population. Unfortunately, by the time America recognized this transition – from weapon to commercial product – the display and imaging technologies had moved offshore, never to return! Without careful consideration, the same fate awaits uncooled thermal imaging components and products. *And the process may have started already.* Consider the very recent award of a US Marine Corps. contract for $300M of thermal weapon sights containing a ULIS microbolometer focal plane made in France! ULIS, unencumbered by any export regulations, has built a technology, cost structure and world-wide business base that makes it even the DoD's recent supplier-of-choice. Unfortunately for American suppliers, this is coming precisely at a time when the social and economic benefits of commercial thermal imaging products are emerging rapidly.

America's technology leadership and long-term investment could - and should - be parlayed into the emerging socially responsible, powerful, profitable, job generating, multi $B commercial business – right here in the US.

Without a doubt, tight export control of American microbolometer products will cause these technologies, products, profits and jobs to follow LCDs and high resolution imagers offshore. In the words of Yogi Bera, "It's déjà vu all over again".

Socially responsible? Primarily commercial? Powerful? Profitable? Because …

Thermal Imaging saves lives.
Thermal imaging has become an important tool in health and medicine. It has found applicability from cancer research to coronary bypass surgery.



Firefighters around the globe consider their thermal imaging cameras (TICs in the trade vocabulary) as basic safety equipment. Introduced for firefighting aboard ships by the British Royal Navy in the 1970s, the technology allows the fireman to safely navigate totally dark rooms filled with smoke - often aiding lifesaving rescues. Search and rescue teams use handheld and airborne thermal cameras to locate the lost or injured in the wilderness or earthquake collapsed buildings.

Thermal imaging presents a large opportunity in automotive safety. Moving from dash displays to autonomous warning and braking systems, thermal imaging systems will be directly involved preventing many thousands of pedestrian deaths each year in vehicle accidents worldwide. Thermal imaging will also be key to the prevention of the over one million collisions with deer in the US alone. Projections estimate that, by 2020, more than a million automobiles will be equipped with thermal night vision systems which may be integrated into - or independent of – autonomous driving systems.

Thermal Imaging saves energy.
Seeing energy saves energy. The heat escaping from buildings is clearly low hanging fruit in the global mission to reduce energy usage. The US DOE estimates that nearly half of the total daily energy consumption in homes and commercial buildings is from heating or cooling which in turn represents a lion's share of the world's overall energy consumption. Thermal imaging is helping us to dramatically reduce the waste. A structural thermal survey, recommended by the DoE and mandated by our Euro-partners, finds the leaks that rob energy. Insulation deficiencies, poor weather stripping, and inadequate windows can easily be detected using a thermal imaging camera and thereby repaired.

By counting people in a room, a thermal imaging sensor can tune HVAC systems and save significant energy. Reducing heating/cooling of unoccupied areas will have a big effect on the world's energy appetite.

Incorporating appropriate optical filters and signal processing, a thermal infrared sensor can visualize natural gas. Leaking natural gas is an undesirable trifecta in today's society – a strong greenhouse gas, a dangerous and potentially explosive fire hazard, and, of course, a pricey wasted energy resource.

Thermal Imaging can keep us safer.

Our security is improved by being able to detect intrusion especially at night using this technology. Police forces and local security companies are relying on the "people glow in the dark" nature of thermal imaging to provide protection and improve safety. With the recent dramatic cost reduction of this technology due to its adoption by the non-military world, thermal security cameras are now commonly installed to protect businesses and even residences.

Thermal Imaging is making a better world.

Thermal imaging is another technology with global economic impact evolving from our military research– commercial aircraft, computer chips, GPS, the Internet, liquid crystal displays and high resolution imagers. As pointed out above, the implications of thermal imaging are significant. Saving precious energy resources, dramatically improving preventative maintenance of high value equipment, crop monitoring of irrigation and fertilization from drones, security at night, food storage and preparation safety, and many other uses beyond contribute to a better tomorrow.

Very low cost thermal imaging monitors are poised to be an important player in the Internet of Things. The positive impact of this technology on humanity is undeniable.

Thermal Imaging: A Global Industry. American Leadership – Today. Tomorrow?

The US thermal imaging industry can continue to generate billions in revenue providing jobs and profits here in the United States, but only if it can compete globally. Worldwide today, 9 out of 10 microbolometer thermal cameras are sold commercially. In 2019, just a few years away, that number will become 19 out of 20. [1] Global commercial investment in thermal imaging products and manufacturing capabilities now far exceeds that of our DoD while worldwide microbolometer production capacity dwarfs any planned military acquisition and possible deployment. Microbolometer arrays of commercial resolution and performance are currently being produced in foreign countries in both Europe and Asia and freely sold around the globe.

Restricting performance levels to less than foreign made devices seriously handicaps US commercial suppliers competing in foreign markets.
Foreign competitors are eager to make these differences– eg limiting picture updates to less than nine per second verses thirty of traditional television video - very visible! Offered side by side next to more capable products of unconstrained offshore competitors, *Made in the USA* will become a warning rather than an inducement!

Incorporation of commercial microbolometer arrays and sensor assemblies into foreign military equipment will not be curtailed by tough export regulations.
Within the US itself, fully capable (array size, frame rate, sensitivity, etc.) matchbox-sized thermal imagers hang on sales hooks in hardware, sporting goods and big box stores across the country, some priced as low as a couple of hundred dollars and sold by the hundreds of thousands, eventually millions, produced by both foreign and domestic manufacturers. FLIR recently announced that in 2016, it manufactured and shipped "over a half million" imagers and cameras – the bulk being microbolometer based. ULIS of France just won part of a $300M contract awarded by the US Marine Corps! At this level of consumer, industrial and even military proliferation, control becomes pointless.

Export policy needs to be visionary as technology is hardly static.
Advancements in just one or two years are often dramatic. Waiting for foreign transfer of technology from research labs to production before making a protracted review of export regulations is akin to licensing the rest of the world to take the lead. Without exportability, the economics just don't justify US domestic investment to keep ahead or even keep up. Commercial investment in the US, needed to develop the next "new and improved" will not occur until there is a dependable worldwide level playing field to compete.

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[1] Uncooled Infrared Imaging Technology & Market Trends, Yole Development, July 2016.

ITAR can easily cripple our domestic capability.
Consider that presently, none of the major suppliers of commercial microbolometer sensors and products produces the underlying silicon IC's in-house. Each uses readily accessible, high-volume "foundries", both here and abroad, to produce wafers of silicon integrated circuits - the starting substrates in the fabrication of microbolometer sensors. Placing ITAR on the design and production of silicon wafers designed for commercial (or military) microbolometers will result in a strong "no-bid" from these foundries. The business volumes of microbolometer "readout integrated circuit" (ROIC) wafers are minuscule compared to other traditional consumer, automotive, and industrial microelectronic production. Asking semiconductor companies to impose ITAR compliance on their large and highly competitive production lines is unrealistic and will be rejected. Although today the technology level required for these devices can be fabricated by foundries domestically, as microbolometer technology progresses, more advanced silicon fabrication will be necessary. Unfortunately, custom design foundry services for the most advanced production processes have moved to Asia, guaranteeing that future generations of advanced microbolometer sensors will be impossible under ITAR.

At the same time, foreign competitors, not constrained by ITAR today or in the future, are clearly demonstrating ROIC design and manufacturing capability – witness the current wide assortment of very capable IRFPAs offered by nations across the globe. This technology is publically well documented in published literature and patents and foreign design houses are accept contracts for new custom and innovative designs.

We believe that the result is obvious and, unfortunately, supported by history.
By encumbering export of microbolometer arrays, sensors, and cameras from the United States, our narrow technical leadership will be readily overtaken - and the suppliers, jobs, business and profits will quickly move offshore. Ironically, this results in the US looking to foreign sources to fill our military needs with the most advanced and economical technology, e.g. the USMC award to ULIS. We only need to ask where the other electronic components in our tanks, ships, and aircraft are being produced. This country owes itself an unobstructed opportunity to compete worldwide in a technology that has such broad and compelling social and economic benefit.

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March 13, 2017

Mr. C. Edward Peartree
Director
DDTC Policy, DOS
Washington DC

Response to Notice of Inquiry – Category XII

Dear Mr. Peartree,

We have reviewed the recently published Notice of Inquiry to add performance parameters for Category XII and for many reasons this request is unwarranted. First and foremost, for the past six years the DOC, DOS and DOD have been working together along with Industry to come up with export control reform for Category XII. The first attempt at the re-write for this category included performance characteristics that were so out of date with current technology that there was outrage from every corner of the US Industrial marketplace. The three agencies went back and came out with a rewrite on controls, which was the presented in early 2016. All three agencies along with Industry were finally able to come together and agree that the second re-write was significantly better than the first and after many months of discussion they were finally enacted into law on December 31, 2017. For what we can ascertain this NOI is a second attempt to put back performance characteristics that were unacceptable in the first round and additionally any attempt to roll back progress and agreements already made by all three agencies. These new performance characteristics are as bad as if not worse than the first set presented and it is clear that when these were being made there was no consideration of products that are already available from foreign or domestic sources(specific examples are listed later within our response).

It is clear that the Government agencies do not understand how Companies and Industries grow and that there is a natural evolution to all products. Growth comes from two directions: Internal and external forces. All companies have internal roadmaps for the evolution of their products.
They want to be the first to come out with something new, to be considered the company that offers leading edge products to set themselves apart from the rest of the marketplace. Imagine for a moment if we had put performance characteristics on things that are now common place items like a cellphones and computers. Are companies not allowed to plan to growth for their company? Are they supposed sit around and wait for the government to tell them what they can and can't do? If companies like, Apple or IBM had performance characteristics forced upon them then we might not have iphones or

ipads. Portable laptops would still use green CRT screens and weigh 15 lbs. All the innovations of today come from companies pushing the edge, trying to do better, be better and faster than their competitors.

The same goes for infrared imaging technology. There has been a natural and planned evolution when it comes to cooled and uncooled infrared detectors and cameras. In the beginning you had 1D sensors then over time 2D detectors were available and cameras were made using these units. Initially these cameras had very low resolution and in most case not higher than 80 x 60. These first units filled an initial need but the push to better was there and then we saw resolution evolve to 160 x 120, 320 x 240 and then 640 x 480/512 to 1024 x 768. As of today 1K sensors are just becoming available and in another few years it is likely we will see 2K or higher sensors become available. Any limitation forced on sensors will means companies that have already invested a significant amount of money to develop the next level of product will have huge financial losses. They will be unable to promote the product and have no recourse on recouping the money spent on internal development efforts.

In addition to natural evolution and internal product roadmaps, there are critical industries that demand better, more sensitive equipment and continue to push companies to do better than what they currently offer. Medical imaging is just one market where they can't settle for good enough. IR cameras are used as a tool used by doctors to diagnose problems. The better sensitivity of the camera the more likely you can catch a problem in the very early stages and that could mean the matter of life or death. The Fire industry is another market where settling must not happen. This is a very dangerous profession where people put their lives at risk every day to save the lives other people. They demand the highest possible resolution for a camera because when then are in a middle of a fire and scanning for victims it makes the difference of rescuing a survivor or leaving them to perish.

Industrial thermography can also have critical requirements for resolution. For example, thermal cameras are common place tool in maintaining health and optimal performance of equipment. Imagine a power company (electrical, water, nuclear) that uses cameras to monitor equipment 24/4 for the first sign of a problem. They need equipment that can detect the smallest of changes in their equipment and in some instances remotely. If they have a camera that is too low resolution and a critical piece of equipment fails because the thermal camera was unable to detect the problem then the failure could be cataclysmic. There are many other industries that also require/demand high resolution and extreme sensitivity without being a military application.

As mentioned previous, we have some specific examples of the problem with the performance characteristics provided and they don't seem to make any sense. It is apparent that the Government has listed commercial specifications that have been out in the marketplace for some time because they are unsure what makes a military specification. There is no clear "brightline" when it comes to specifications.

Example 1: New regulations for section C under the ITAR is supposed to be for end items. The NOI seems to jumble up and make no real difference between end items and components. C(1) are listed binoculars, monoculars & goggles. If you look at the NOI it appears C(1) would now be considered B (i)

(ii) (iii) (iv) (v) and if that is the case, then what are items F, G & H under the NOI? How do they correlate to what is on the current regulations? Are these end items (for what purposes)? Are these raw components? If yes, they why are they not referring to section E of the new regulations. Even if you put this problem aside, the performance limitation don't make sense. In F you have a limiting resolution of 64 lp/mm and in G you have a limiting resolution of 57 lp/mm. These are already lower than the typical response you would get from either the Photonis XD4 or XR5 image intensifier. The XR5 is an auto-gating unit that has a minimum resolution of 64 lp/mm and a typical resolution of 72 lp/mm and the XD4 has a minimum resolution if 57lp/mm and a typical resolution 64 /p/mm. Typical means when they deliver a unit that is what they "typically" deliver to the customer. So anyone can get an auto-gate system with resolution of 72 lp/mm. In the new regulations you also list the luminous sensitivity is now limited to 1800 µA/lm. How did you come up with this as the limiting factor? What is the justification for adding this new performance characteristic when this has never been a criteria for export control? Lastly, if you look at the Photonis website www.photonis.com you will see they are now offering a 16mm image intensifier tube but have not publically listed the performance specs. Therefore, how can the US be subjected to performance specs when there a new items and current items that are foreign available that are better performing than what you are looking to allow?

Example 2: Section L of discusses SWIR type detectors, supposedly. Is this supposed to be just the detector or is this an end item? On this one there is a limitation on elements from greater than 81,920 pixels and not to exceed 327,680 pixel. Are you aware that there is a camera put out by Raptor Photonics www.raptorphotonics.com/ called the Owl1280 that incorporates a SWIR detector that is a 1280 x 1024, which is significantly higher than the 327,680. In fact it has over 1.3M pixel elements. Therefore you are informing the US Industrial base that we are limited to 640 x 512 pixels for SWIR but the UK can offer a product that is 1.3M pixels. Yet again, the Government has failed to recognize products that are in active production that has significantly higher specifications that what they are looking to allow for the US. In addition, Xenics www.xenics.com/en is another company that offers a SWIR product and their current offering is a 640 x 512 at this time but how are to know that within the next year or two they won't introduce a new unit with higher resolution. By limiting resolution and putting a time line on development assures that the US Industrial base will not move forward in making any advancement in products and only allows international companies to continue to expand and improve their product offerings.

There are many other examples regarding infrared detectors that the new performance specifications dip back down into commercial aspects and have not taken into account what is already available in the marketplace. In general these are so bad that it could take another five to six pages to point out all the problems with L through T listed on the NOI.

To switch gears for a moment, I would like to say that the regulations that were enacted into law on December 31, 2016 showed significant progress in the understanding on what is to be commercial vs military. Most military applications are consider tactical, image acquisition to allow a target to be destroyed or eliminated. Commercial applications are to show detection as soon as possible to identify a problem but the main difference is that the commercial application tries to fix he situation and

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determine a way for this problem not to occur again. One specific example of improvement was in terms of regulations on cryocoolers for cameras based on cooled IDDCA. Every day we are contacted by companies looking to make a unit for port surveillance or other civil security applications or general inspection/monitoring applications where they need to run a unit 24/ and need a system that at a minimum of offers and MTBF (mean time between failure) of 10,000+ hours. With the new regulations that were put into place we can now work with these companies and provide cyrocoolers that could meet this spec. This demand is not a military request it is civil request and any change to this specification would be disastrous for our companies

For years we have had products subjected to the ITAR that are purely commercial in intent, design, development and use. But because of a single component used within the system was deemed as ITAR it made the whole product ITAR. The new regulations in place allow companies who offer products that are commercial in nature the ability to finally have the correct status for the product. Reissuing performance characteristic would reserve this progress and would have a negative financial impact.

Equipment that is deemed military should have the original design intent to be for use for a military application and then only those products should be included under the ITAR. Any attempt to put back performance characteristic that or put a time line of internal development efforts is counter intuitive and frankly is just plain wrong.

Bottom line, the Government had over six years to come up with export control reform and they actually achieved success. This NOI is a feeble attempt to undermine all the effort and progress made by the Department of Commerce, Department of State and Department of Defense as well as industry therefore this NOI should be thrown out in its entirely.

Regards,

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March 14, 2017

Regulatory Policy Division
Bureau of Industry and Security
U.S. Department of Commerce
14th Street and Pennsylvania Ave., N.W.
Room 2099B
Washington, D.C. 20230

Subject: BIS Notice of Inquiry, RIN 0694-XC035

To Whom It May Concern:

Thank you for this opportunity to comment regarding potential changes to the recently finalized Category VI of the Commerce Control List.

SPIE is the largest international not-for-profit society in optics, photonics and imaging. Together with our 19,000 individual members and 650 corporate members, the Society seeks to build a better world with light through scientific education and innovation.

Photonics is an exciting growth area based on light. Photonic components (optics, sensors, fibers, photodetectors, light modulators, lasers, etc.) themselves make up a substantial global product market of more than $150 billion, with around 700,000 jobs. When basic photonic products are added (such as displays, the optical telecommunications hardware, equipment for precision production and metrology for manufacturing, solar energy converters, LED lighting, cameras and light based medical instruments) the product market is calculated at $500 billion with 2.2 million jobs worldwide. Photonics, as an enabling technology, underpins many trillions in the services of today's economy, including data, entertainment, and e-commerce. Advances in photonics are key to the future of consumer brand name companies such as Google, Apple, Facebook, as well as realizing solutions to familiar diseases.

For some decades SPIE has run the largest open scientific meeting covering science and technology of the infrared (IR) segment of photonics. The global market for IR imaging comprises many related but different market segments, each with different characteristics. The underlying IR sensor technologies may also differ. Market segments include military, homeland security, aerospace & defense, firefighting, environmental, industrial, and automotive applications. Consumer-electronics applications of IR imaging are also an emerging and growing market. Together, the overall global market for IR imaging was $6.43 B in 2015 according to a July 2016 report from marketsandmarkets.com, which also projects the market will grow at a CAGR of 8.32% between 2016 and 2022 to reach $11.36 B in 2022.

While the current market shares of Europe and the Asia-Pacific regions are smaller than the United States, Asia-Pacific in particular offers greater potential future growth opportunities because the ongoing "commoditization" of the underlying IR technologies. Technology commoditization will continue to be a major market trend as IR sensing capabilities are combined with smart-phone cameras and become as ubiquitous as visible-wavelength cameras. Their development will continue to erode the cost of access to IR imaging at all levels, making this technology more widely accessible than ever before.

In addition, manufacture and assembly of these types of components and systems is becoming increasingly globalized as optics and photonics manufacturing capabilities continue to migrate offshore. As a result, companies are finding it ever more difficult to maintain U.S.-based manufacturing capabilities for critical technologies when the larger commercial markets are restricted due to ITAR controls.

Advances in IR, and the other technology areas covered by this NOI, by countries outside of the United States is demonstrated through the technical papers submitted and presentation made at SPIE conferences. Attached is an excel document listing applicable papers submitted in the last calendar year, 2016.

As you can see from the listing, though the U.S. is a part of the elite community of government and private-sector researchers who are continuing to further this technology, they are by far not alone. Recent developments are broadly shared throughout the community worldwide. Some examples of the papers submitted last year include:

> "Design, development, characterization and qualification of infrared focal plane area array detectors for space-borne imaging applications"
> -Space Applications Ctr. (India)
>
> "Design of a micro uncooled infrared imaging system based on VOx IRFPA"
> -Beijing Institute of Technology; North GuangWei Technology Inc. (China)
>
> "A 1024×768-12μm digital ROIC for uncooled microbolometer FPAs"
> -Mikro-Tasarim Elektronik San. ve Tic. A.Ş. (Turkey)
>
> "A low noise readout integrated circuit for Nb5N6 microbolometer array detector"
> -Nanjing University (China)
>
> "Research overview on reliability of infrared focal plane array detector assemblies"
> -Luoyang Institute of Electro-Optical Equipment (China)
>
> "Implementation of TDI based digital pixel ROIC with 15μm pixel pitch"
> -Sabanci University (Turkey)

"Study on cathode high voltage pulse control in image intensifier"
- North Night Vision Technology Group Co.; Science and Technology on Low-Light-Level Night Vision Lab. (China)

Additionally, the 2016 papers submitted show the great potential for commercial applications in this technology space. For example:

"Aerospace laser communications technology as enabler for worldwide quantum key distribution"
-Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)

"Applications of multi-spectral imaging: failsafe industrial flame detector"
-Honeywell Automation & Control Solutions (United States)

"Fire testing and infrared thermography of oak barrels filled with distilled spirits"
-FM Global (United States)

"Investigating the performance of a low-cost thermal imager for forestry applications"
-Newcastle University; Forest Research (United Kingdom)

SPIE was highly involved with the rewrite of Category XII of the USML and corresponding Category VI of the CCL as part of the Export Control Reform (ECR) initiative. We engaged the community we represent to respond to the two proposed rules for this category. Though we can still identify areas within the U.S. export control system that industry desires improvement, overall we were pleased with the final regulations for this category of controls, which is the culmination of countless hours of work by the interagency, industry and universities.

SPIE would like to see the regulations for CCL Category VI remain as written, and wait for further evaluation of potential changes after the current regulations have been in place for 18 months to two years. After this time has passed under the current regulations, we can better assess the benefits and any potential negative consequences of the regulations as written.

Once again, this NOI seeks to put back in place additional license requirements and remove licenses exceptions, including the addition of a license requirement for exports to Canada (a proposed provision in the first proposed rule that was soundly rebuked by commenters). Given the international availability of the items included in the ECCN's listed in this NOI, SPIE does not believe that the additional controls proposed are justified. SPIE is concerned that instituting a control structure as proposed in this NOI will limit U.S. companies from pursuing commercial opportunities, giving these markets over the international competition and

ultimately hurting the U.S. industrial base. Over control at any level does not benefit the US economy, academic institutions or national security.

We would also like to take this opportunity to thank the agencies involved for your time and dedication to reaching a much improved final regulation for USML Category XII and CCL Category VI, and urge the inter-agency to let these regulations stand as written. As always, we remain ready as a resource to the administration as you work to institute well-written and precise regulations that balance the realities of commercial interests and competition, with national security needs.

Thank you again for this opportunity to comment.

Sincerely,

Eugene Arthurs
CEO
SPIE, the international society for optics and photonics

United Technologies Corporation
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Submitted Via Email

March 14, 2017

Christopher Costanzo
Bureau of Industry and Security
U.S. Department of Commerce
Washington, D.C. 20230

Attn: RIN 0694-XC035

Re: Notice of Inquiry; Increase of Controls: Infrared Detection Items (82 Fed. Reg. 4287, January 13, 2017)

Dear Mr. Costanzo:

United Technologies Corporation ("UTC")[1] appreciates the opportunity to submit this comment with respect to the Bureau of Industry and Security's ("BIS's") Notice of Inquiry ("NOI") for increasing controls of infrared detection items.

License Exception Strategic Trade Authorization ("STA") authorizes the export, re-export and/or retransfer, of items subject to certain Commodity Control List-based controls (*e.g.*, national security, crime control, etc.), to countries identified in Country Group A:5 and A:6, when certain conditions are satisfied. *See* 15 C.F.R. §740.20. Currently, infrared imaging cameras controlled in Export Control Classification Number ("ECCN") 6A003.b.4 are eligible to be exported, re-exported and/or retransferred under License Exception STA. *See id.* The ability for exporters and re-exporters to utilize STA provides significant benefits, of which exporters and re-exporters of 6A003 cameras, to include UTC, have availed themselves of during the last few years.[2]

In its NOI, BIS has raised the potential of eliminating STA eligibility for infrared imaging cameras controlled in ECCN 6A003.b.4 if they are: (1) being exported to be embedded into a higher level assembly, system, or equipment; and (2) incorporate two dimensional focal

[1] UTC is a global, diversified corporation based in Farmington, Connecticut, supplying high technology products and services to the aerospace and building systems industries. UTC's companies are industry leaders, among them Pratt & Whitney, Otis, UTC Aerospace Systems, UTC Climate, Controls & Security, and United Technologies Research Center.

[2] According to a document posted on BIS's website and titled "STA use through June 2016," items classified under ECCN 6A003 appear to be the third most frequently exported under License Exception STA through June 2016, to countries identified in Country Group A:5. *See* https://www.bis.doc.gov/index.php/forms-documents/technology-evaluation/ote-data-portal/ecr-analysis/1537-sta-use-july-2011-june-2016/file.

plane arrays ("FPAs") specified in either ECCN 6A002.a.3.c or ECCN 6A002.a.3.f and have more than 328,000 detector elements. *See* 82 Fed. Reg. 4287, 4288. BIS has offered the following rational for the potential revision: "*Removing STA eligibility for such items will ensure that those infrared imaging cameras to be embedded (e.g., kits, cores, modules) that could exceed the size of those incorporated in military fielded systems, receive U.S. Government review when exported for incorporation into commercial/civil equipment and systems.*" *See id*. For the reasons addressed below, UTC recommends that BIS does not propose the aforementioned revisions in future rulemaking.

The cameras controlled in ECCN 6A003.b.4 can be for incorporation into higher level assemblies or for use as standalone end items. As such, only a portion of exported/re-exported cameras classified under ECCN 6A003.b.4 would be outside the scope of License Exception STA (*i.e.*, License Exception STA would remain available for cameras exported/re-exported as standalone items).

The cameras controlled in ECCN 6A003.b.4 and incorporating ECCN 6A002.a.3.c or ECCN 6A002.a.4.f FPAs are currently available outside of the United States. The OWL 1280 SWIR camera, manufactured by Raptor Photonics, located in the United Kingdom[3], and the Cardinal 1280 HD FPA, manufactured by SemiConductor Devices, located in Israel[4], serve as examples of such cameras currently available outside of the United States. In addition to the current availability of ECCN 6A003.b.4 cameras incorporating certain FPAs, UTC expects that the foreign market will continue to expand making the availability of the cameras even more widely available. As the targeted cameras are already available outside of the United States and the availability is expected to expand, the addition of licensing requirements will place industry in the United States at a competitive disadvantage with its foreign competitors.

* * *

For additional information, please contact Andrew Hayes at (202) 336-7478 or andrew.hayes@utc.com or Michael Wetzel at (609) 333-8331or michael.wetzel@utas.utc.com.

Sincerely,

Peter S. Jordan
Executive Director & Associate General Counsel, International Trade Compliance
United Technologies Corporation

[3] OWL 1280 SWIR Camera. *See* http://www.raptorphotonics.com/products/owl-1280-swir/
[4] Cardinal 1280 HD. *See* http://www.scd.co.il/http-www.scd.co.il-SCD-Templates-showpage.aspDBID%3D1-LNGID%3D1-TMID%3D108-FID%3D1387-IID%3D1808