EDU

INFRAMET educational services

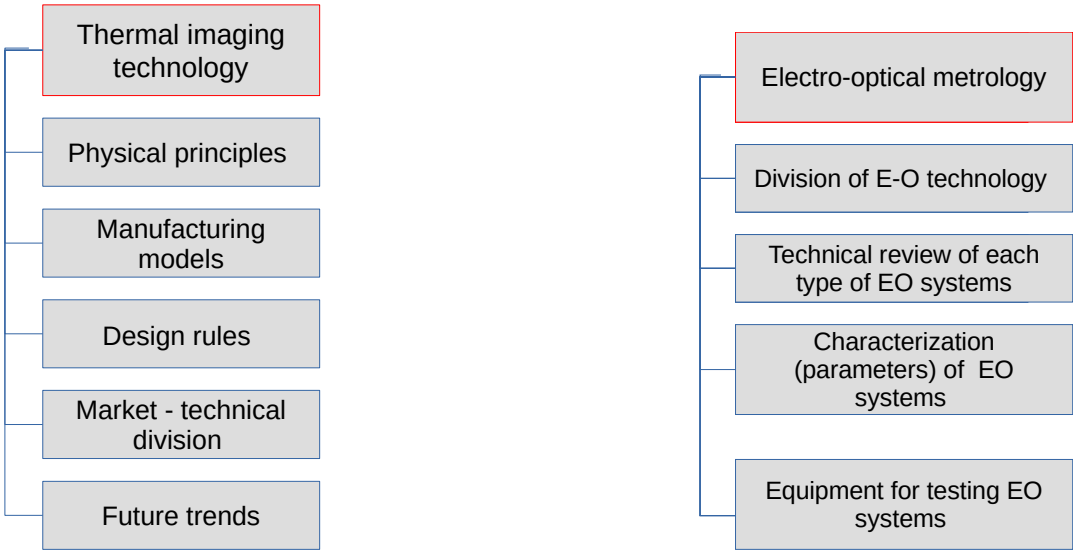

Fig. 1. Basic programs of two major types of educational services

1 Why educational training?

Inframet is basically a top world manufacturer of equipment for testing electro-optical imaging/laser systems. Therefore main task is Inframet is manufacturing test systems and modules of such systems (thermal imagers, VIS-NIR cameras, SWIR imagers, laser range finders, laser pointers, multi sensor imaging/laser systems, optical sights, night vision devices, image intensifier tubes). It is typical that Inframet engineers carry out short (several days) operational training having aim to train customer to do proper operation/maintenance of delivered test systems. However, Inframet can deliver also more expanded educational training as it possesses unique scientific know how in field of EO technology that expands much beyond test equipment.

2 Types of educational services

Inframet offers two main types of expanded educational services:

1. **Thermal imaging technology:** physical principles, manufacturing models, design rules, technical divisions, future trends
2. **Electro-optical imaging/laser metrology**: division of electro-optical technology, short technical review of each types of EO systems, characterizations, equipment and methods of testing EO systems

The first course is especially targeted for teams that want design of new thermal imagers and need to master design rules and understand present/future technical trends of this fascinating technology. The course can be also useful for anyone who needs practical knowledge on physical principles, manufacturing models, design rules, technical divisions, future trends of thermal imaging.

The second course is targeted for scientific institutions/governmental agencies who want to understand division of EO technology, principles of work of each types of EO systems, and characterizations and testing of EO imaging/laser systems (including practical tests of exemplary EO systems). The course includes also standardization of test method, optimal tender requirements, optimal test system and proper interpretation of measurement results.

Due to huge size of EO technology (at least nine types) some customers are not interested in total EO imaging/laser technology. In such situation the course can be limited to interesting parts like:

1. Electronic imaging systems (thermal imagers, VIS-NIR cameras, SWIR imagers, multi sensor imaging/laser systems)
2. Classical night vision and optical systems (optical sights, night vision devices, image intensifier tubes).

3 Time table

1. Course no 1 is typically carried out within 3 working days.
2. Course no 2 is typically carried out within 10 working days (total EO technology).

4 Training programs

4.1 Program for Thermal imaging technology course

1. Basic physics of thermal imaging
2. Generations of thermal imagers
3. Models of manufacturing thermal imagers
4. Blocks of thermal imagers

4.1 IR FPA image sensor
- 4.1.1 Types of IR FPA sensors
- 4.1.2 Sensor cooling
- 4.1.3 Sensor spectral band
- 4.1.4 Resolution/pixel size of IR FPA image sensor
- 4.1.5 Maximal frame rate of output image
- 4.1.6 ROIC type
- 4.1.7 Testing IR FPA sensors

4.2 FPA controller
- 4.2.1 Aim of FPA controller
- 4.2.2 Specialized FPA controllers versus universal FPA controllers
- 4.2.3 Design diagram of FPA controllers
- 4.2.4 Bias generator
- 4.5 Pattern/Clock generator
- 4.2.6 Analogue amplifier/digital converter
- 4.2.7 System on chip
- 4.2.8 Image enhancement block
- 4.2.9 Video interface
- 4 2.10 Proximity board
- 4.2.11 Testing FPA controllers

4.3 Optical objective
- 4.3.1 Basic work concept
- 4.3.2 Characterization IR objectives
- 4.3.3 Comparison of IR objectives to VNIR objectives
- 4.3.4 Selecting IR optical materials
- 4.3.5 Design of IR objectives
- 4.3.6 Manufacturing/testing optical components
- 4.3.7 Assembling/testing IR objectives

4.4 Imager housing

4.5 Optional blocks

5 Methods of image enhancement

5.1 Correction of spatial noise

5.2 Regulation of imager temperature span

5.3 Image quality improvements methods

6 Commercial division of thermal imagers

7 Technical division of thermal imagers

7.1 Sensor cooling

7.2 Imager spectral band

7.3 Radiometric calibration

7.4 Imagers of different type of output image
- 7.4.1 Optical output imagers
- 7.4.2 Electronic output imagers

7.5 Maximal surveillance range

7.6 Radiometric measurement capabilities
- 7.6.1 Thermography cameras
- 7.6.2 Optical gas imaging thermal imagers
- 7.6.3 FireFighting cameras

7.7 Integration with other imaging/laser systems

8 Future of thermal imaging

8.1 Automotive thermal images
8.2 Long life, low size/weight/power cooled thermal imagers
8.3 High sampling thermal imagers
8.4 Ultra high image resolution thermal imagers
8.5 Fusion thermal imagers
8.6 Renaissance of cooled LWIR thermal imagers
8.7 Super range thermal imagers
8.8 Folded thermal imagers
8. 9 Space thermal imagers for Earth observation
8.10 Mass manufacturing of thermal imagers
9 Summary

Attention: The course is carried out in form of lectures supported by demonstration of practical thermal imagers.

4.2 Program for Electro-optical metrology course

1. Division of EO surveillance systems
2. Introduction to boresight EO systems
3. Thermal imagers
3.1 Review of thermal imaging technology
3.2 Parameters and boresight errors of thermal imagers
3.3 Equipment for testing and boresight thermal imagers
3.4 Practical demonstration of systems for testing thermal imagers - system operation and measurement of parameters
3.5 Test of thermal imagers by students under trainer supervision
4. VIS-NIR cameras and SWIR imagers
4.1 Review of VIS-SWIR imaging technology
4.2 Parameters and boresight errors of VIS-SWIR cameras
4.3 Equipment for testing VIS-NIR cameras and SWIR imagers
4.4 Practical demonstration of systems for testing VIS-NIR cameras and SWIR imagers operation and measurement of parameters
4.5 Test of VIS-NIR cameras and SWIR imagers by students under trainer supervision
5. Laser systems
5.1 Review of laser technology for EO surveillance systems (LRFs, designators, pointers)
5.2 Parameters and boresight errors of LRFs, designators, pointers (including tender requirements and standards)
5. 3 Equipment for testing and boresight LRFs, designators, pointers
5.4 Practical demonstration of systems for testing LRFs, designators, pointers - operation and measurement of parameters
5.5 Test of LRFs, designators, pointers by students under trainer supervision
6. Multi sensor systems
    1. Review of multi sensor surveillance systems technology
    2. Parameters and boresight errors of multi sensor surveillance systems
    3. Equipment for testing and boresight multi sensor systems
    4. Practical demonstration of systems for testing multi sensor systems operation and measurement of parameters
    5. Practical tests of multisensor systems by students
7. Night vision devices
    1. Review of night vision technology
    2. Parameters and boresight errors of NVDs
    3. Equipment for testing NVD
    4. Practical demonstration of systems for testing NVDs - system operation and measurement of parameters
    5. Test of NVDs by students under trainer supervision
    6. Parameters image intensifiers
    7. Practical demonstration of systems for testing II tubes - system operation and measurement of parameters
    8. Test of II tubes by students under trainer supervision
8. Optical sights
    1. Review optical sights technology
    2. Parameters and boresight errors of telescopic sights (including tender requirements and standards)
    3. Equipment for testing and boresight telescopic sights
    4. Practical demonstration of systems for testing telescopic sights - operation and measurement of parameters

5. Test of optical sights by students under trainer supervision

9. Questions and answers session

Attention: The course is carried out in form of lectures followed by demonstration of practical tests by supervisor. Finally tests are carried out by students. It can be estimated that at least 50% of training times is used for work on real test systems.

5 Types of course organization

The courses are organized in two different ways:

1. Special training for a group of people only from a single institution (date and program according to customer preferences)
2. Scheduled training for a group of students from several institutions (group up to 16 people).

Inframet has obtained a series of positive references from students who attended the educational training on metrology of EO surveillance systems.

If you have further questions about the educational training then please contact us.

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