MULTIC

Testers of broadband multi-spectral imaging systems

Fig. 1. Photo of the MULTIC400 test system (without additional TCB blackbody block)

1 Basic information

Broadband multispectral imaging systems are the most advance group of electro-optical imaging systems for ultra long range surveillance or space remote sensing. These systems of critical importance in both defense and civilian applications. They are built by combining several typical bandpass imagers (like thermal imager, VIS-NIR camera, SWIR camera) with a VIS-SWIR multispectral/hyperspectral imager (capable to capture images in dozens of narrow spectral bands) into a single broadband multi-spectral imaging system. These system are typically of extremely big size due to use of several large aperture optical objectives. MULTIC is a high-tech specialized test system developed for testing long range broadband multispectral imaging systems.

2 System design

MULTIC is a calibrated image projector capable to projects reference images of different shape/size/light intensity at different spectral bands from visible to far infrared range. It is a classical test concept but design of MULTIC is based on a new design concept. Classical test systems are typically built using a series (at least four) .exchangeable radiation sources located at focal plane of a multi-folded off axis reflective collimator. All blocks of the test system including collimator mirrors are directly fixed to the optical table. MULTIC is built as an off axis Newton type collimator of fixed, compact structure having a set of exchangeable reference targets located at collimator focal plane and irradiated during most of tests by a single broadband multispectral radiation source. This special radiation source coded as VASIP is the heart of this test system. Additional TCB blackbody is used to carry out some tests specific for thermal imagers.

This new design concept enables to achieve ultra wide test capabilities keeping at the same time ultra high system boresight accuracy and reliability.

In detail, the MUTIC system is built from following blocks:

1. CDT off axis reflective collimator (typical collimator apertures are 400mm or 500mm)
2. VASIP14D broadband multispectral light source – as a calibrated source of light in VIS-SWIR band and non calibrated source in MWIR-LWIR range
3. TCB4D blackbody – calibrated radiation source in MWIR-LWIR range
4. Set of two MRW-6L rotary wheels
5. WEB wheel exchange block – to exchange MRW wheel with VASIP light source for MRW-8 wheel with TCB blackbody as an active radiation source
6. Set of targets
7. PC set
8. Set of frame grabbers
9. Control software (VASIP Control program, TCB Control, Borex Control)
10. Test software (TAS-V program, SUB-V program, SUB-T program, TAS-T program, SPEC program, BOR program) for measurement of parameters of tested systems
11. Set of tables (two AT1012 optical tables as antivibration platform for MULTIC system, MT77 movable table as antivibration platform of regulated height for tested system, PCT80 desktop table for PC set)
12. BOREX stage – to be used as rotation platform for tested system with internal imaging autocollimator.

3 Versions

MULTIC system is offered in two main versions based on two collimators of identical focal length 5m but of different aperture: 400m or 500mm. Test capabilities of both versions (MULTIC400 and MULTIC 500) are the same. MULTIC systems based on different collimators can be optionally offered, too.

4 Test capabilities

Multic enables typically tests of large broadband multispectral imagers of optical aperture below 400/500mm depending on version. Detail test capabilities of MULTIC systems are presented in tables below.

Table 1. Test capabilities of MULTIC system with VASIP light source as an active radiation source

Thermal imagers	VIS-NIR camera	SWIR camera	VIS-SWIR hyperspectral imager
1. FOV, 2. distortion 3. MTF,	1. FOV, 2. distortion 3. MTF, 4. NEI (noise equivalent illuminance), 5. Spatial noise (FPN, non uniformity) 6. MRC (minimum resolvable contrast). 7. Response function (linearity, dynamic range) 8. relative spectral sensitivity 9. color accuracy (option)	1. FOV, 2. distortion 3. MTF, 4. NER (noise equivalent radiance), 5. Spatial noise (FPN, non uniformity) 6. MRC (minimum resolvable contrast). 7. Response function (linearity, dynamic range) 8. relative spectral sensitivity (step measurement) 9. D* normalized detectivity	1. FOV, 2. keystone distortion 3. smile distortion 4. MTF, 5. NER (noise equivalent radiance), 6. Spatial noise (FPN, non uniformity) 7. Response function (linearity, dynamic range) 8. MRC (minimum resolvable contrast) 9. D* normalized detectivity
Alignment errors: 1. Measurement of angles between optical axis of hyperspectral imager working at different spectral bands 2. Measurement of angles between optical axis of hyperspectral imager relative to thermal imager (or VIS NIR camera or SWIR camera). 3. Measurement of rotation angle between images from hyperspectral imager relative to images from thermal imager and images from VIS NIR camera/SWIR cameras. 4. Measurement of angles between optical axis of the same imager/camera but while changing FOV 5. Measurement of angles between optical axis of VIS-NIR camera (or SWIR camera, or hyperspectral VIS-SWIR imager, or thermal imager) to a reference mechanical plane (axis) of BOREX platform			

Table 2. Test capabilities of MULTIC system with TCB-4D blackbody

Thermal imagers	VIS-NIR camera	VIS-SWIR hyperspectral imagers
1. MTF, 2. NETD, 3. MRTD. 4. MDTD 5. Spatial noise (FPN, non uniformity) 6. D* - option	-------	-----

5 Options

VASIP light source is near perfect calibrated light source in VIS-SWIR spectral band. TCB is a perfect radiation source in MWIR-LWIR range. However there are sometimes applications that requires high intensity calibrated light source in UV-VIS spectral band. Inframet offer XE150-A light source for this application.

6 Summary

MULTIC is a new generation of systems for testing broadband multispectral imaging systems. Old cumbersome, quasi manually operated test systems built as a collection of different light sources, targets, mirrors located on a large optical table are replaced by a semi automated,.compact and user friendly test system. At the same time higher test speed and test accuracy is achieved.

Version 2.1

CONTACT:

Tel: +48 22 6668780 Fax: +48 22 3987244 Email: info@inframet.com