



The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at ***wvOASIS.gov***. As part of the State of West Virginia’s procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at ***WVPurchasing.gov*** with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.

## Header

List View

General Information | Contact | Default Values | Discount | Document Information

Procurement Folder: 133225

SO Doc Code: CRFQ

Procurement Type: Central Master Agreement

SO Dept: 0313

Vendor ID:

SO Doc ID: DEP1600000016

Legal Name: THRASHER GROUP INC

Published Date: 10/5/15

Alias/DBA:

Close Date: 10/29/15

Total Bid: \$751,375.00

Close Time: 13:30

Response Date:

Status: Closed

Response Time:

Solicitation Description:

Total of Header Attachments: 0

Total of All Attachments: 0



Purchasing Division  
 2019 Washington Street East  
 Post Office Box 50130  
 Charleston, WV 25305-0130

**State of West Virginia  
 Solicitation Response**

**Proc Folder :** 133225

**Solicitation Description :** Addendum 01: Mapping Services in Southern West Virginia

**Proc Type :** Central Master Agreement

Date issued	Solicitation Closes	Solicitation No	Version
	2015-10-29 13:30:00	SR 0313 ESR10281500000001802	1

**VENDOR**

000000204789  
 THRASHER GROUP INC

**FOR INFORMATION CONTACT THE BUYER**

Beth Collins  
 (304) 558-2157  
 beth.a.collins@wv.gov

Signature X	FEIN #	DATE
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All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	Control Surveying	600.00000	HOUR	\$110.000000	\$66,000.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
2	Topographic, Planimetric and Check Surveying	1800.00000	HOUR	\$110.000000	\$198,000.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
3	Terrestrial LIDAR Collection	600.00000	HOUR	\$150.000000	\$90,000.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
5	Topographic Mapping - Aerial Photography (0-25 Acres)	15.00000	ACRE	\$600.000000	\$9,000.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** (including LIDAR Collections)List only one rate for each category. Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
6	Topographic Mapping - Aerial Photography (25-50 Acres)	30.00000	ACRE	\$300.000000	\$9,000.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** (including LIDAR Collections)List only one rate for each category. Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
7	Topographic Mapping - Aerial Photography (50-100 Acres)	75.00000	ACRE	\$150.000000	\$11,250.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** (including LIDAR Collections)List only one rate for each category. Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
8	Topographic Mapping - Aerial Photography (Over 100 Acres)	125.00000	ACRE	\$125.000000	\$15,625.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** (including LIDAR Collections)List only one rate for each category. Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
9	Licensed Land Surveyor	600.00000	HOUR	\$125.000000	\$75,000.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** Professional Rates (Listed Disciplines Only) Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
10	Survey Manager	1200.00000	HOUR	\$95.000000	\$114,000.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** Professional Rates (Listed Disciplines Only)  
Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
11	Mapping/CAD Technician	2400.00000	HOUR	\$65.000000	\$156,000.00

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** Professional Rates (Listed Disciplines Only)  
Quantities are estimated and are for bidding purposes only, these are not guaranteed.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
12	Travel Per Diem (Rate/Person)Day)	125.00000	EA	\$60.000000	\$7,500.00

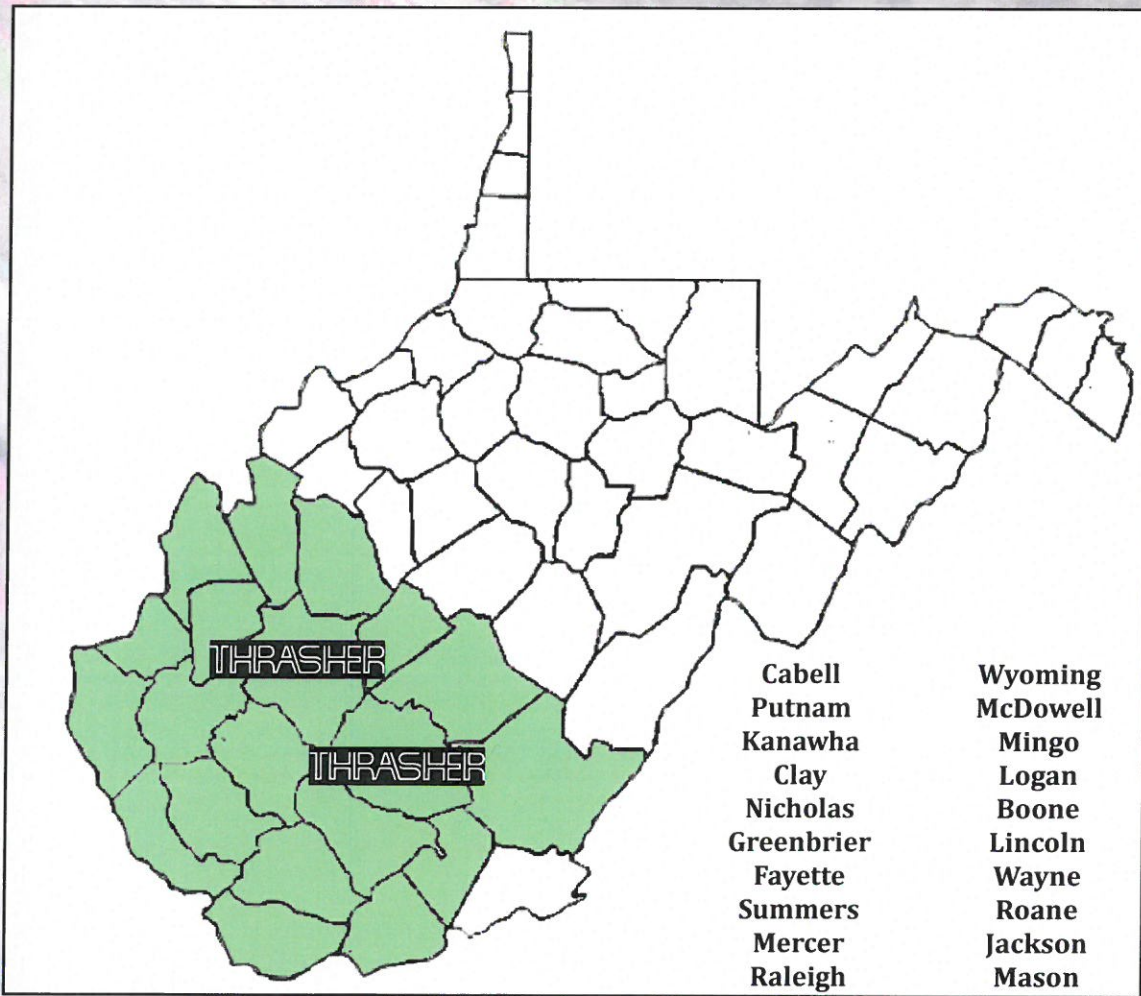
Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :** Applicable to Survey Crews Only  
Quantities are estimated and are for bidding purposes only, these are not guaranteed.

EXPRESSION OF INTEREST  
Mapping Services for Southern West Virginia

DEP 16000000016

October 29, 2015



**THRASHER**

600 WHITE OAKS BLVD.  
BRIDGEPORT, WV 26330  
[www.thrashereng.com](http://www.thrashereng.com)

October 29, 2015

Department of Administration, Purchasing Division  
2019 Washington Street East  
Charleston, WV 25305-0130

RE: DEP 16000000016

Dear Members of the Selection Committee:

For decades, Thrasher has worked on projects involving the West Virginia Department of Environmental Protection. As West Virginia's largest privately owned engineering firm, we specialize in multidisciplinary engineering services, including survey and mapping services.

We employ one of the largest survey departments in the Mid-Atlantic region and offer a wide range of land surveying and related services for federal, state, and private clients. We are committed to evolving our techniques and equipment to best serve our clients and their growing needs. Thrasher's experience with survey has evolved into mapping focusing on our ability to analyze, process, and visualize information to assist in solving problems and making sound business decisions. The team at Thrasher utilizes commercially available software as well as develop custom GIS software to provide workable tools that are user friendly for resolving everyday issues.

Thrasher has first hand experience in working with a variety of clients to provide the survey and mapping needed to successfully complete projects. We understand the impact survey and mapping has on DEP AML projects, as we have completed dozens of mine reclamation projects across West Virginia.

Thrasher looks forward to the opportunity to interview for this very important task and continuing our working relationship with the DEP for the benefit of AML projects.

Sincerely,



CHADWICK D. BILLER, PE  
Partner, Principal-in-Charge



## TABLE OF CONTENTS

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- Control Survey Price
- Topographic, Planimetric and Check Surveying
- Terrestrial LIDAR Collection
- Mobile Scanner
- Topographic Mapping Aerial Photography (0-25 acres)
- Topographic Mapping Aerial Photography (25-50 acres)
- Topographic Mapping Aerial Photography (50-100 acres)
- Topographic Mapping Aerial Photography (Over 100 acres)
- Licensed Land Surveyor
- Survey Manager
- Mapping/CAD Technician
- Travel Per Diem ((Rate/Person) Day)

### Thrasher's Response to Southern Mapping

- Background
- Related Services
- Related Experience
- Project Team
- Equipment

### Certified Signature Page

### Addendum Acknowledgment Form



Purchasing Division  
 2019 Washington Street East  
 Post Office Box 50130  
 Charleston, WV 25305-0130

State of West Virginia  
 Request for Quotation

Proc Folder: 133225

Doc Description: Addendum 01: Mapping Services in Southern West Virginia

Proc Type: Central Master Agreement

Date Issued	Solicitation Closes	Solicitation No	Version
2015-10-05	2015-10-29 13:30:00	CRFQ 0313 DEP1600000016	2

**BID RECEIVING LOCATION**

BID CLERK  
 DEPARTMENT OF ADMINISTRATION  
 PURCHASING DIVISION  
 2019 WASHINGTON ST E  
 CHARLESTON WV 25305  
 US

**VENDOR**

Vendor Name, Address and Telephone Number:

**FOR INFORMATION CONTACT THE BUYER**

Beth Collins  
 (304) 558-2157  
 beth.a.collins@wv.gov

Signature X

*Beth Collins*

FEIN #

*55-0033596*

DATE

*10/28/2015*

All offers subject to all terms and conditions contained in this solicitation

**ADDITIONAL INFORMATION:**

Addendum No. 01

This addendum is issued to modify the solicitation per the attached documentation and the following:

1. To delete line 4 on the commodity lines for 'Mobile Scanner' this line was added in error.
2. To upload the correct General Terms and Conditions.

The bid opening date will remain the same of October 29, 2015 at 1:30 PM, EST

No other changes.

CRFQ

THE WEST VIRGINIA STATE PURCHASING DIVISION FOR THE AGENCY, THE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION, IS SOLICITING BIDS FOR AN OPEN END CONTRACT FOR MAPPING SERVICES IN THE SOUTHERN COUNTIES OF WEST VIRGINIA, PER THE ATTACHED SPECIFICATIONS AND DOCUMENTATION.

INVOICE TO		SHIP TO	
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV25304 US		ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV 25304 US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Control Surveying	600.00000	HOUR		Electronic

Comm Code	Manufacturer	Specification	Model #
81151601			

Extended Description :

Quantities are estimated and are for bidding purposes only, these are not guaranteed.

INVOICE TO		SHIP TO	
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV25304 US		ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV 25304 US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
2	Topographic, Planimetric and Check Surveying	1800.00000	HOUR		Electronic

Comm Code	Manufacturer	Specification	Model #
81151601			

Extended Description :

Quantities are estimated and are for bidding purposes only, these are not guaranteed.

INVOICE TO		SHIP TO	
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV25304 US		ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV 25304 US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
3	Terrestrial LIDAR Collection	600.00000	HOUR		<i>Electronic</i>

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**  
Quantities are estimated and are for bidding purposes only, these are not guaranteed.

INVOICE TO		SHIP TO	
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV25304 US		ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV 25304 US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
4	Mobile Scanner	300.00000	HOUR		<i>Electronic</i>

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**  
Line is inactive.  
Quantities are estimated and are for bidding purposes only, these are not guaranteed.

INVOICE TO		SHIP TO	
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV25304 US		ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV 25304 US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
5	Topographic Mapping - Aerial Photography (0-25 Acres)	15.00000	ACRE		<i>Electronic</i>

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**

(including LIDAR Collections)List only one rate for each category.  
Quantities are estimated and are for bidding purposes only, these are not guaranteed.

INVOICE TO		SHIP TO	
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV25304	ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV 25304

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
6	Topographic Mapping - Aerial Photography (25-50 Acres)	30.00000	ACRE		<i>Electronic</i>

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**

(including LIDAR Collections)List only one rate for each category.  
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INVOICE TO		SHIP TO	
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV25304	ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV 25304

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
7	Topographic Mapping - Aerial Photography (50-100 Acres)	75.00000	ACRE		<i>Electronic</i>

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**

(including LIDAR Collections)List only one rate for each category.  
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INVOICE TO		SHIP TO	
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV25304	ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV 25304

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
8	Topographic Mapping - Aerial Photography (Over 100 Acres)	125.00000	ACRE		Electronic

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**  
 (including LIDAR Collections)List only one rate for each category.  
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ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV25304	ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV 25304

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
9	Licensed Land Surveyor	600.00000	HOUR		Electronic

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**  
 Professional Rates (Listed Disciplines Only)  
 Quantities are estimated and are for bidding purposes only, these are not guaranteed.

INVOICE TO		SHIP TO	
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV25304	ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON US	WV 25304

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
10	Survey Manager	1200.00000	HOUR		Electronic

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**

Professional Rates (Listed Disciplines Only)

Quantities are estimated and are for bidding purposes only, these are not guaranteed.

INVOICE TO	SHIP TO
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV25304 US	ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV 25304 US

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
11	Mapping/CAD Technician	2400.00000	HOUR		<i>Electronic</i>

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**

Professional Rates (Listed Disciplines Only)

Quantities are estimated and are for bidding purposes only, these are not guaranteed.

INVOICE TO	SHIP TO
ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV25304 US	ENVIRONMENTAL PROTECTION OFFICE OF AML&R 601 57TH ST SE CHARLESTON WV 25304 US

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
12	Travel Per Diem (Rate/Person)Day)	125.00000	EA		<i>Electronic</i>

Comm Code	Manufacturer	Specification	Model #
81151601			

**Extended Description :**

Applicable to Survey Crews Only

Quantities are estimated and are for bidding purposes only, these are not guaranteed.

**SCHEDULE OF EVENTS**

Line	Event	Event Date
1	Tech Question Submittal Deadline at 5:00 PM	08/10-02

# THRASHER'S BACKGROUND

Thrasher is a privately owned engineering firm that specializes in multidisciplinary engineering services. Established in 1983, Thrasher is built on stable leadership, financial strength and reputation. Our dedication to creative design solutions, well-managed projects and customer service has made Thrasher West Virginia's largest privately owned engineering firm and an industry leader in the Mid-Atlantic region.

Since our formation, the company has grown to a firm of more than 350 employees. Our diverse staff has the resources to handle many projects, both large and small, simultaneously. Our client base is diverse and includes municipalities, state and federal government agencies, secondary and higher education, public and private entities, etc.

## Principals:

H. Wood "Woody" Thrasher, PE  
 Kenneth P. Moran, PE, PS  
 Chad M. Riley, PE  
 Daniel E. Ferrell, PE  
 Wm. Randy Watson, PE  
 Clay P. Riley, PE  
 Jonathan Carpenter, PE  
 Chadwick D. Biller, PE  
 Craig Baker, Associate AIA  
 Robert R. Milne, PE  
 Ron Stanley, CPA  
 Jenelle Armstrong, PE  
 Matt Fluharty, PE

## Our Locations:

Bridgeport, West Virginia  
 Charleston, West Virginia  
 Beckley, West Virginia  
 Oakland, Maryland  
 Canton, Ohio  
 Fredericksburg, Virginia  
 Canonsburg, Pennsylvania

## Multi-Disciplinary Services:

Civil Engineering  
 Utility Services  
 Land and Site Development  
 Roadways  
 Bridges  
 Streetscapes  
 Airports  
 Storm Water Systems  
 Environmental Services  
 Architecture  
 Land Planning  
 Landscape Architecture  
 Construction Monitoring  
 Materials Testing  
 Pipeline Inspection  
 GIS Mapping



# RELATED SERVICES

## SURVEY

Thrasher employs one of the largest survey departments in the Mid-Atlantic region and offers a wide range of land surveying and related services for federal, state, and private clients. We are committed to evolving our techniques and equipment to best serve our clients and their growing needs.

At Thrasher, we are able to provide both surveying and engineering services which provide a distinct advantage over survey-only companies. The combination of these two services provide our surveyors with a better understanding of what engineers and architects require to develop an appropriate design for different types of projects. Our field and survey personnel offer extensive experience, certified training, and flexibility to meet our clients' unique project schedules.

### GENERAL SURVEY SERVICES:

- Large-scale Boundary Work
- Topographic Survey and Mapping
- ALTA/ACSM Survey and Mapping
- Lake and River Soundings
- Accident Reconstruction Survey and Mapping
- Drug-free Zone Mapping
- Expert Witness Testimony
- Construction Layout
- Permanent Project GPS Base Stations
- Building Control and Layout
- Road/Bridge Alignment and Staking
- Sewer/Water/Pipeline
- Site Layout
- Quality Assurance Surveying
- Volume/Quantity Surveys
- As-Built Surveys

### GPS SURVEYS:

- Geodetic Control Networks
- Ground Control for Aerial Mapping
- Telecommunications
- FAA 1A and 2C Letters

### ROUTE LOCATION SURVEYS:

- Transmission Lines
- Natural Gas Pipelines
- Wind Turbine
- Roadway, Railway and Rec Trails

### COAL AND ENERGY SURVEYS:

- Pre and Post Mining Blast Surveys
- Water Quality Monitoring Plan
- Construction Layout
- Emergency Control Survey/Plans



# RELATED EXPERIENCE

Thrasher has worked with the Department of Environmental Protection to successfully complete the following AML projects. Thrasher is aware of the importance of accurate survey and mapping that is needed to get these projects to engineering design.

**Roaring Creek**

- Portals, Subsidence Depressions, Dewatering of Farm pond into subsided areas

**Anglins Run**

- Portals and AMD

**Squire's Creek**

- Portals, Highwall, AMD and Refuse

**Overfield (Lafferty)**

- Clogged Stream, Portal and Landslide

**Clarksburg (Lyons) Landslide**

- 2 acre Landslide

**Lauren Run #1**

- Portals, Highwall and AMD

**Pleasant Valley (Brown)**

- Portals, Highwall and AMD

**Roger Camp Hill**

- 1/2 Acre AMD Impoundment and Refuse

**Stowe (Prince) Landslide**

- Emergency Landslide

**Owl Creek #2**

- Portals, Highwalls, AMD and Refuse

**Landgraff Refuse Pile**

- Refuse

**Canyon Refuse and Dump**

- Portals, Highwalls and Refuse

**BEFORE****AFTER**

## RELATED EXPERIENCE

Thrasher has successfully completed topographic surveys and aerial mapping for the following coal companies in and surrounding West Virginia.

**Apogee Coal Company**  
Scott Depot, West Virginia

**ARCH/Beckley, LLC**  
Eccles, West Virginia

**ARCH/Mountain Laurel Mining**  
Sharples, West Virginia

**Greenbrier Minerals, Coronado Coal II**  
Rupert, West Virginia

**MET Resources**  
Bridgeport, West Virginia

**Pinnacle Mining LLC**  
Cleveland, Ohio

**Sugar Camp Energy, LLC**  
Macedonia, Illinois

**Vecellio & Grogan, Inc.**  
Beckley, West Virginia

**Mid-Vol Coal Sales**  
Princeton, West Virginia

**Berkeley Land Surveyors, Inc.**  
Berkeley Springs, West Virginia

**Cliffs Logan County Coal, LLC**  
Cleveland, Ohio

**Magnum Coal Company**  
Yolyn, West Virginia



## RELATED EXPERIENCE

Thrasher's survey teams have performed numerous survey assignments for the WVDOH through our Statewide Agreement. The following is a list of recent projects:

**Brooke County - Route 2**

Prepared right-of-way plans, legal descriptions, plats, field surveys

**Putnam County - Route 35**

Prepared route location surveys, right-of-way plans, legal descriptions, plats, field surveys

**Fairmont Connector - Construction Stakeout for Mountaineer Contractors**

Construction layout, quantity surveys

**Hurricane Creek Road - WVDOH Project #U340-35-4.40 00**

Construction layout, property corner verifications, GPS control verifications, GPS control confirmation, cemetery location, electronic deliverables, and route location surveys for 6 miles of proposed roadway.

**Lodgeville Road - WVDOH Project # X317-50/76-00.00 00**

Prepared route location surveys, right-of-way plans, legal descriptions, plats, field surveys

**Jakes Run Arch Bridge - WVDOH Project #BR0007(180)**

Prepared right-of-way plans, legal descriptions, plats, field surveys

**Old Bridgeport Hill Drainage - WVDOH Project # S317-20/75-0.43 00**

Prepared right-of-way plans, legal descriptions, plats, field survey

**SR 279 North Bridgeport By-Pass - WVDOH Project #X317-279-0.00**

Performed route location surveys, construction layout, prepared right-of-way plans, legal descriptions, plats, field surveys

**Route 11 Near Musselman High School - WVDOH Project # U302-11-4.36**

Prepared right-of-way plans, legal descriptions, plats, field surveys

**King Coal Hwy Baisden-Mudlick - WVDOH Project #U330-52-44.70 00 C-2**

Prepared right-of-way plans, legal descriptions, plats, field surveys

**Corridor H, Grant County, West Virginia - WVDOH Project #X312- H-79.05 00**

Prepared route location surveys, right-of-way plans, legal descriptions, plats, field surveys

## RELATED EXPERIENCE

Thrasher has completed every phase of topographical survey and mapping needed to properly execute site development for various confidential oil and gas clients. Examples of this work includes the following:

**Confidential Client**

500 mile survey, mapping and alignment sheets

**West Virginia Confidential Client**

34 mile survey, mapping, erosion and sediment control plans and routing recommendations

**West Virginia Confidential Client**

60 mile survey for construction of propane line

**Marion and Monongalia Counties, West Virginia**

8,000 linear feet of survey and drawings completed within 4 months

**TL 536/ TL 543 in Wellsville, NY**

22 mile survey, wetland survey, as-built survey and mapping completed within 10 months

**LN-19 in Delmont, Pa**

2 mile as-built survey for gas transmission line completed within 3 months

**TL260 in Bridgeport, Harrison County, WV**

1.5 mile survey for gas transmission line completed within 3 months

**Tioga/Storage Field in Tioga, PA**

4.8 mile stakeout, survey and mapping completed within 10 weeks

**TL-272 in Cornwell Compressor Station, Clendenin, WV**

Two hundred foot of as-built survey in Kanawha County, West Virginia completed within 1 month

**TL-570/TL-263 Boone County, WV**

6.4 mile survey for rural areas of Boone County, West Virginia. completed within 7 months

**TL-342/EXT.4 Waynesburg, Pa**

9.7 mile pre-construction survey in Greene County, Pennsylvania completed within 3 months

# RELATED EXPERIENCE

## TRANSMISSION/ DISTRIBUTION LINE FIELD SURVEY EXPERIENCE

Specific examples of project experience for transmission lines include:

Performed boundary, ALTA, topographic, and/or control and construction stakeout surveys for substation sites at:

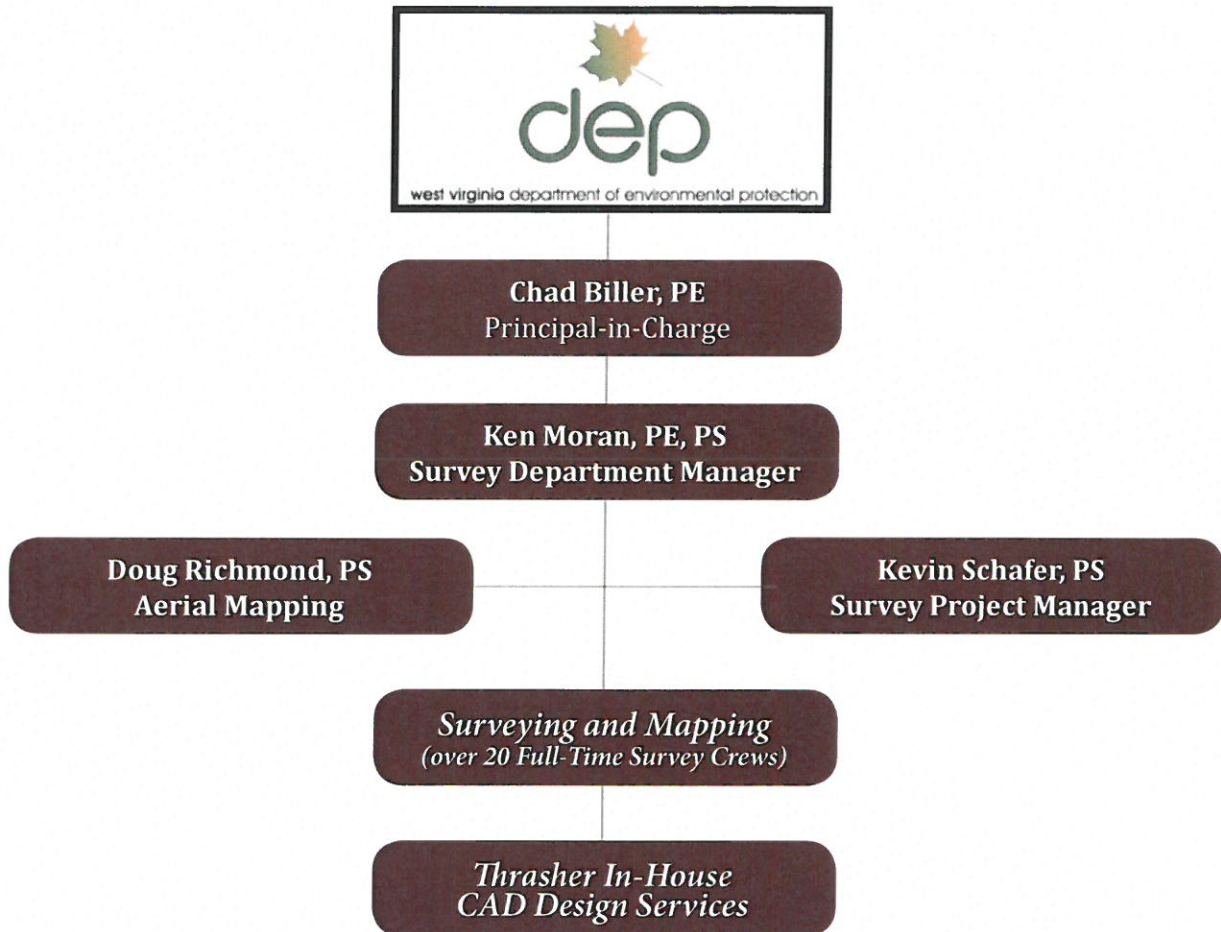
Lazenby – Mercer County, WV  
Jarrod – Raleigh County, WV  
McGraws – Wyoming County, WV  
Caretta – McDowell County, WV  
Hall's Ridge – Mercer County, WV  
Patrick Street – Kanawha, WV  
Claypool Hill – Tazewell County, VA  
Spectra Energy – Washington County, VA  
Garrison Switch – Boone County, WV  
Rockhouse Road – Boone County, WV  
Lockhart – Dickenson County, VA  
Cross Lanes – Kanawha County, WV  
Patrick Street – Kanawha County, WV  
Lanham – Kanawha County, WV  
Duffield – Scott County, VA  
Wellmont – Sullivan County, TN

Performed Transmission Line Surveys at:

McGraws – Wyoming County, WV  
Patrick Street – Kanawha County, WV  
Halls Ridge – Mercer County, WV  
Lockhart – Dickenson County, VA  
Spectra Energy – Washington County, VA  
Jaeger-Wharncliffe – McDowell/Mingo County, WV  
Duffield, Scott County, VA



PROJECT TEAM



Contract Manager: Kevin Schafer  
Telephone Number: (304) 343-7601  
Cell Phone Number: (304) 918-3308  
Fax Number: (304)624-7831  
E-Mail Address: kschafer@thrashereng.com

# PROJECT TEAM

## **Chadwick Biller, PE** **Principal-in-Charge**

In 1999, Chad Biller, PE, joined the team at Thrasher and is now a partner within the firm. Mr. Biller has extensive experience in all aspects of civil engineering. He has successfully completed hundreds of projects for the WVDEP and WVDOT. Chad has a clear understanding of the procedures required for the DEP, as he has completed over a dozen AML restoration projects. Chad's knowledge of this type of project will be helpful to the survey and mapping team.

### **Education:**

- Bachelor of Science, Civil Engineering - West Virginia University

### **Registrations:**

- Registered Professional Engineer
  - States of West Virginia, Pennsylvania, and Ohio

### **Affiliations/Certifications:**

- American Society of Highway Engineers
- American Society of Civil Engineers
- National Society of Professional Engineers

### **Related Experience Includes:**

- **WVDOT Corridor H, Davis to Bismark—Mr. Biller served as Principal-In-Charge/Project Manager for the design of over two miles of a four-lane divided highway. This roadway includes an additional 1.5 miles of secondary roads.**
- **WVDOT Jakes Run Bridge— Mr. Biller served as Principal-In-Charge/Project Manager for the design of a 95 foot long, single span steel girder bridge, roadway approaches, water line relocation and right-of-way .**
- **WVDOT Orlando Bridge— Mr. Biller served as Principal-In-Charge/Project Manager for the single concrete box beam bridge with approximately 1,000 LF of roadway realignment.**
- **Landgraff Refuse Pile: Involved a ± 3 acres exposed refuse site, 500 linear feet of dangerous highwall and streambank restoration of an unnamed tributary of Elkhorn Creek. The scope of work for this project included regrading the refuse site from the unnamed tributary's stream bank and to reclaim the highwall. Then an adjoining borrow sites were used to obtain sufficient suitable material to entomb the refuse for re-vegetation. The project site covered a total area of 4.3 acres and reclamation included ±16,000 cubic yards of earthwork.**
- **Stowe Landslide: Involved a 2 acre landslide caused an abandoned portal blowout. The slide mass was situated directly above a private residence at the base of a steep mountainside. The slide material upon removal was transported to a nearby waste site, spread, dried and compacted. The project site covered a total area of 2.9 acres and reclamation included ± 6,000 cubic yards of earthwork.**



# PROJECT TEAM

## **Ken Moran, PE, PS** **Survey Department Manager**

Kenneth P. Moran, PE, PS, serves as Vice President of Thrasher. Mr. Moran is the Chief Operating Officer of Thrasher and the manager of the Survey Division within the firm. His areas of responsibility include quality assurance and quality control of engineering design and survey services for projects ranging from well site development through midstream.

Aside from his work in the oil and gas field, Mr. Moran has extensive experience in all aspects of engineering and surveying with an emphasis on project management and administration. Ken works on both large-scale, multi-million dollar projects as well as smaller community improvement projects.

### **Education:**

- Bachelor of Science, Civil Engineering Technology - Fairmont State University

### **Registrations:**

- Registered Professional Engineer
  - States of West Virginia, Virginia, and Ohio
- Registered Professional Land Surveyor
  - State of West Virginia

### **Related Experience Includes:**

- **Statewide Aerial Survey/Mapping Open End Contract - Statewide, West Virginia**
- **WVDOH Road Widening (Big Elm) - Harrison County, West Virginia**
- **WVDOH Robert C. Byrd High School Access Road - Harrison County, West Virginia**
- **Doddridge County Recreation Park Phase I Property Development - Doddridge County, West Virginia**
- **Confidential Client - 500 mile survey, mapping and alignment sheets**
- **West Virginia Confidential Client - 34 mile survey, mapping, erosion and sediment control plans and routing recommendations**
- **West Virginia Confidential Client - 60 mile survey for construction of propane line**
- **Marion and Monongalia Counties, West Virginia - 8,000 linear feet of survey and drawings completed within 4 months**
- **TL 536/ TL 543 in Wellsville, NY - 22 mile survey, wetland survey, as-built survey and mapping completed within 10 months**

# PROJECT TEAM

## Doug Richmond, PS Aerial Mapping

Douglas Richmond joined Thrasher in 2012 and serves as a Senior Survey Manager for the firm, as well as heads up the entire Survey Division in Virginia. Mr. Richmond has experience nationally and internationally in survey construction, engineering, GPS scales and technical support and training related to the fields of surveying and mapping for public and private clients.

Mr. Richmond has performed numerous integrated survey projects utilizing GNSS, Robotic Total Station, 3D Laser Scanning, Hydrographic Tools, and Photogrammetry.

### Education:

- Bachelor of Science, Civil Engineering - University of New Orleans

### Registrations:

- Registered Professional Surveyor  
Commonwealth of Virginia [REDACTED], State of Louisiana, [REDACTED], Ohio [REDACTED], Texas [REDACTED],  
Mississippi [REDACTED], Alabama [REDACTED], and North Carolina [REDACTED]

### Affiliations/Certifications:

- **Certified Floodplain Manager**
- **Virginia Association of Surveyors**
- **Virginia Association of Mapping and Land Information System**

### Related Experience:

- **NGS Height Modernization Surveys - various locations**
- **FAA Airport Surveys - various locations**
- **Mid-Atlantic & Midwest NAVFAC Projects (VA, MD, DC, MI, MN, WI, ND, SD, IA, NE) - various locations**

# PROJECT TEAM

## Kevin Schafer, PS Survey Project Manager

Mr. Schafer has over 28 years of experience in the field of surveying. His areas of expertise include; easement and right-of-way surveys, as-built surveys, subdivision design and layout, construction and site surveys, topographic surveys, water and sewer line surveys, boundary surveys, accident surveys, oil and gas surveys, ALTA/ASCM Land Title Surveys and GPS surveying. He has given expert testimony in court cases in Putnam, Nicholas, and Kanawha counties. His responsibilities include; management, supervision and development of staff for all surveying projects.

Mr. Schafer has obtained a vast experience in the both the field and office aspects of surveying. He is very knowledgeable in area of computer mapping using AutoCAD products. Along with his surveying experience he has also worked on WVDOH projects, Delaware D.O.T. projects, Virginia D.O.T. projects, AML reclamation projects, hazardous waste site projects and bridge projects.

### Education:

- Valencia Community College, Orlando, FL

### Registrations:

- Professional Land Surveyor:  
State of West Virginia  
State of Kentucky

### Related Experience:

- **Boundary Surveys - Completed over two thousand boundary surveys throughout the State of West Virginia.**
- **West Virginia-American Water Company - Charleston, West Virginia- Surveys for the construction of Plant Sites, Tank Sites, and Booster Stations, throughout the state.**
- **South Charleston Annexation Survey - Kanawha County, West Virginia - Research, field work, drafting for annexation plat for the Southridge Centre area addition to the corporate limits of the City of South Charleston.**
- **Woodbridge Subdivision - Charleston, West Virginia - Design, plans and layout based upon field survey of over 200 acres. Assisted with the preparation of the Subdivision plans and was responsible for the survey crews setting property corners.**

# EQUIPMENT

The following is a summary of the available equipment that Thrasher owns. Attached in the appendix, is a complete list of our equipment with calibrations:

- 46- total stations, 8 of these are Trimble Robotic Total stations, other are compiled of Nikon Nivo's, Topcons, and Leica Total Stations- All calibrated within the last year.
- 69-Trimble R-8's
- 42-Trimble R-10's
- 63-Trimble TSC3's
- 2 Trimble Geo-7x
- 5 Trimble Geo XH6000
- 7 Trimble Geo XR6000
- 28 Trimble TDL 450H Repeaters
- 5 Metro Tech Spar Units
- 19 Levels, Trimble, Leica and Topcons

Please see attached camera calibration report.

**Thrasher Equipment Matrix**

**R-8**

DESCRIPTION	MODEL	S/N	ASSIGNMENT	WARRANTY EXP. APR 16	FIRMWARE 5.01	2015 P/LI LIST
TRIMBLE-R8	R8 Model 3	508453633	Scott Whitlock	No Warranty????????????		X
TRIMBLE-R8	R8 Model 4	522940001	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5433475877	Josh Oyer (OH)	16-Apr		X
TRIMBLE-R8	R8 Model 4	5414462260	Chris Defino (PA.)	NO WARRANTY		X
TRIMBLE-R8	R8 Model 4	5220487625	David Boyd (VA.)	16-Apr		X
TRIMBLE-R8	R8 Model 4	5316433917	Charleston Office			
TRIMBLE-R8	R8 Model 4	5414461814	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5414461814	Josh Knealey	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5414461809	Mark Gallagher	16-Apr		X
TRIMBLE-R8	R8 Model 4	5414461761	Mark Gallagher	16-Apr		X
TRIMBLE-R8	R8 Model 4	5410457626	@ Work Station in Garage	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5132470499	@ Work Station in Garage	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5414461849	Drake Lewis	16-Apr		X
TRIMBLE-R8	R8 Model 3	5251421574	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5414461821	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5316434005	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5316434113	Tyler Riffe	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5414461847	Mac Fullmer	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5243499258	David Pitt	16-Apr		X
TRIMBLE-R8	R8 Model 3	5247417232	Joseph Lambert (Beckley)			X
TRIMBLE-R8	R8 Model 3	5414462256	Joe Dodson (VA.)	No Warranty????????????		X
TRIMBLE-R8	R8 Model 4	5423467764	Gregg Goodwin	NO WARRANTY		X
TRIMBLE-R8	R8 Model 3	4918170714	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	4921173275	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	4921173278	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	4921173297	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5316434035	Cage	16-Apr		X
TRIMBLE-R8	R8 Model 3	4934400707	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	4943404641	Cage w/ 5251421574	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	4943404641	Mike Walker (Canton OH)			X
TRIMBLE-R8	R8 Model 3	4943404660	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	4943404666	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5026435651	Cage (Adam Cooper)	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5026435652	Cage w/ 5216485800	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5026435662	Chris Baker	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5026435701	Kirk Wilson	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5044538444	Jonathan Dennison	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5046453635	James Howes	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5104030217	Scott Whitlock	Equipment Moving		
TRIMBLE-R8	R8 Model 3	5046453635	John Leary	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5046453706	Rob Lynch	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5046453934	Mike Brown (OH)	16-Apr		X
TRIMBLE-R8	R8 Model 3	5047450004	Oakland (Spare)	16-Apr		X
TRIMBLE-R8	R8 Model 3	5106461055	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5106461115	Toby Paul (Canton OH)	16-Apr		X
TRIMBLE-R8	R8 Model 3	5106461136	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5114644687	Eddie Weefall	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5126448197	Canton Office	16-Apr		X
TRIMBLE-R8	R8 Model 3	5126448122	Rob Lynch	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5139417305	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5152478840	????????????????????	Removed	Removed	Removed
TRIMBLE-R8	R8 Model 3	5152478848	Kirk Wilson	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5215485599	????????????????????	Removed	Removed	Removed
TRIMBLE-R8	R8 Model 3	5215485743	Found in Cage 7225/15	Removed	Removed	Removed
TRIMBLE-R8	R8 Model 3	5215485800	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5216485800	Cage w/ 5026435652	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5216485819	Jarrett Lantz	16-Apr		X
TRIMBLE-R8	R8 Model 3	5220487390	Fredricksburg Office	16-Apr		X
TRIMBLE-R8	R8 Model 3	5220487415	Justin Gordon	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5220487626	David Boyd (VA.)	No Warranty		X
TRIMBLE-R8	R8 Model 3	5220487748	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5225490460	Andrew Middleton	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5226491548	Bud Bargy (MD)	16-Apr		X
TRIMBLE-R8	R8 Model 3	5235494511	Bryan Hudkins	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5235494513	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5242498554	Oakland (Spare)	16-Apr		X
TRIMBLE-R8	R8 Model 3	5251421600	Cage w/ 4943404641	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5243499332	Toby Paul (Canton OH)	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5206435710	PRENTEE / ?????????			X
TRIMBLE-R8	R8 Model 3	5206435653	Cage	16-Apr	X	X
TRIMBLE-R8	R8 Model 3	5243499333	Jason Garrett	16-Apr	X	X
TRIMBLE-R8	R8 Model 4	5329440587	Andy Stull	Have no record	Have no record	

**R-10**

DESCRIPTION	MODEL	S/N	ASSIGNMENT	WARRANTY EXP. APR-16	FIRMWARE 5.01	2015 P/LI LIST
TRIMBLE-R10	001-60	5312430256	Bryan Hudkins	16-Apr	X	X
TRIMBLE-R10	001-60	5306426306	Fredricksburg, David Boyd	16-Apr		X
TRIMBLE-R10	001-60	5220487390	Fredricksburg			
TRIMBLE-R10	001-60	5252422269	Cage	16-Apr	X	X
TRIMBLE-R10	001-60	5306426368	Jarrett Lantz			X
TRIMBLE-R10	001-60	5320436619	Andrew Middleton	16-Apr	X	X
TRIMBLE-R10	001-60	5306426549	Tyler Riffe	16-Apr	X	X
TRIMBLE-R10	001-60	5313432348	Cage	16-Apr	X	X
TRIMBLE-R10	001-60	5312430350	Cage	16-Apr	X	X
TRIMBLE-R10	001-60	5302423131	Joe Lowther	16-Apr	X	X
TRIMBLE-R10	001-60	5306426795	Andy Stull (Beckley)			X
TRIMBLE-R10	001-60	5311428620	Jonathan Dennison	16-Apr	X	X
TRIMBLE-R10	001-60	5313432363	Mike Walker (Canton OH)			X
TRIMBLE-R10	001-60	5242498180	Cage	16-Apr	X	X
TRIMBLE-R10	001-60	5306426566	Chris Baker	16-Apr	X	X
TRIMBLE-R10	001-60	5410456414	Scott Whitlock			X
TRIMBLE-R10	001-60	5410456424	Joseph Lambert	NO WARRANTY		
TRIMBLE-R10	001-60	5242498177	Chris Defino (PA.)	NO WARRANTY		X
TRIMBLE-R10	001-60	5412459660	Cage (No Warranty)			
TRIMBLE-R10	001-60	5439479452	James Howes	16-Apr	X	X
TRIMBLE-R10	001-60	5406453896	Brent Budecker	16-Apr	X	X
TRIMBLE-R10	001-60	5435477234	Gregg Goodwin	NO WARRANTY		X
TRIMBLE-R10	001-60	5430473543	Joe Dodson (Va.)	16-Apr		X
TRIMBLE-R10	001-60	5324438795	Andy Stull (Beckley)	16-Apr		X
TRIMBLE-R10	001-60	5335442476	Mike Brown (Charleston)	16-Apr		X
TRIMBLE-R10	001-60	5322437945	Kirk Wilson	16-Apr	X	X
TRIMBLE-R10	001-60	5313432433	Justin Gordon	16-Apr	X	X
TRIMBLE-R10	001-60	5324438838	Jason Garrett	16-Apr	X	X
TRIMBLE-R10	001-60	5324438746	Eddie Weefall	16-Apr	X	X
TRIMBLE-R10	001-60	5320436678	????????????????????			X
TRIMBLE-R10	001-60	5406453896	Max Eglin	16-Apr	X	X

TRIMBLE R10	001-60	5312430283	Scott Whitlock	16-Apr		X
TRIMBLE R10	001-60	5411454547	Drake Levo	16-Apr		X
TRIMBLE R10	001-60	5320436622	Cage	16-Apr	X	
TRIMBLE R10	001-60	5413460447	Phil Odonnell (Beckley)			X
TRIMBLE R10	001-60	5413460395	Cage (No Warranty)	No Warranty	Removed	Removed
TRIMBLE R10	001-60	5412460054	Bud Bargy (MD)	16-Apr	X	X
TRIMBLE R10	001-60	5413460399	John Leary	16-Apr	X	X
TRIMBLE R10	001-60	5413460789	Adam Cooper (Cage)	16-Apr	X	X
TRIMBLE R10	001-60	5413460597	Josh Knickely	16-Apr	X	X
TRIMBLE R10	001-60	5336442889	J. Dw (Beckley)			X
TRIMBLE R10	001-60	5413460795	Fredericksburg Office	16-Apr	X	X
TRIMBLE R10	001-60	5320436612	Mapping Dept.	16-Apr	X	X
TRIMBLE R10	001-60	5320423142	Josh Oyler	16-Apr	X	X
TRIMBLE R10	001-60	5324438761	Cage	16-Apr	X	X
TRIMBLE R10	001-60	5408454957	Aaron Rowe	16-Apr	X	X
TRIMBLE R10	001-60	5408454968	David Pratt	No Warranty	Removed	Removed

### LEVELS

DESCRIPTION	MODEL	BRAND	S/N	ASSIGNMENT	CALIBRATION EXP. DATE	2015 PU LIST
Level	DNA05	Leica	344903	Fredericksburg Office	Needs Calibrated	
Level	AT-B3	Topcon	403435	Austin Thrasher		
Level	AT-B3	Topcon	N03400	Mikey Brown (OH)	Needs Calibrated	
Level	AT-B3	Topcon	N01551	Kirk Wilson	Needs Calibrated	
Level	NA730	Leica	5368775	Josh Oyler (OH)	Needs Calibrated	
Level	AT-B4	Topcon	X57866	????????????????????????????		
Level	AT-B3	Topcon	N01549	Rob Lynch	Needs Calibrated	
Level	AT-B3	Topcon	487284	Eddie Westfall	Needs Calibrated	
Level	AE-7	Nikon	249205	Robert Stark		
Level	AT-B8	Topcon	486368	Cage		
Level	NA730	Leica	10812	Cage (Damaged)		
Level	AT-42	Topcon	R10812	Andrew Middleton	Needs Calibrated	
Level	B21	SOKKIA	416773	Toby Paul (OH)	Needs Calibrated	
Level	AT-B3	Topcon	N01548	Aaron Rowe	Needs Calibrated	
Level	AP-8	Nikon	508124	Bryan Hudlins	13-Mar	
Level	NA730	Leica	5083760	Mike Walker (Canton OH)	Needs Calibrated	
Level	AT-B8	Topcon	N01532	Jarrett Lautz	Needs Calibrated	
Level	AT-B4	Topcon	N57833	Robert Stark		
Level	AP-8	Nikon	510890	James Howes	Needs Calibrated	
Level	AP-8	Nikon	510886	????????????????????????????		
Level	AP-8	Nikon	510894	Johnathon Demmon	15-Oct	
Level	AP-8	Nikon	510786	????????????????????????????		
Level	DINI 12	Trimble	7000981	Rob Lynch		
Level	TS20A	Lietz	D10168/18297	Cage		
Level	B2A	Lietz	D10322/128330	Cage		
Level	AT-22A	Topcon	B12545	Mike Woodall		
Level	AT-53	Topcon	0477	Joseph Lambert	Needs Calibrated	

### TOTAL STATION INSTRUMENTS

DESCRIPTION	MODEL	BRAND	S/N	ASSIGNMENT	CALIBRATION EXP. DATE	2015 PU LIST
Robot	S3	Trimble	91412810	Jarrett Lautz	Needs Calibrated	X
Robot	S3	Trimble	91411129	Rob Lynch	5/15 "Past Due"	X
Robot	S3	Trimble	91411222	Johnathon Demmon	15-Sep	X
Robot	S3	Trimble	91411253	Canton Office	Needs Calibrated	X
Robot	S3	Trimble	91411678	Drake Levo	15-Aug	X
Robot	S3	Trimble	93010708	Analy Staff	16-Jun	X
Robot	S6	Trimble	93310288	Fredericksburg Office (VA)	No Date Supplied	X
Robot	VX	Trimble	93710432	Gregg Goodwin	15-Oct	X
Total station	TC-303	Leica	681755	Bryan Hudlins		
Total station	TC-405	Leica	755979	Cage		
Total station	TC-405	Leica	842490	????????????????????????????		
Total station	TC-405	Leica	842627	Shi Wilson	16-Sep	X
Total station	TC-405	Leica	698960	Out for Repair 8/28/15		
Total station	TC-405	Leica	854303	Gregg Goodwin	16-Apr	X
Total station	TC-703	Leica	647516	Cage (DWB not Connect)	16-Apr	X
Total station	TCR 405	Leica	847890	Josh Knickely		
Total station	TCR 703	Leica	641383	BB		
Total station	TCR 403	Leica	698965	John Leary	15-Sep	X
Total station	TS-02	Leica	1322649	Mikey Brown	4/15 Past Due	X
Total station	TS-02	Leica	1322785	Cage		
Total station	TS-02	Leica	1322734	Schrader		
Total station	TS-02	Leica	1322793	John Demmon		
Total station	TS-02	Leica	1322785	Eddie Westfall	16-Jun	X
Total station	TS403	Leica	757668	Bud Bargy (MD)		
Total station	Nivo 3M	Nikon	A151363	Cage	15-Aug	X
Total station	Nivo 3M	Nikon	A152138	Cage	15-Jun	X
Total station	Nivo 3M	Nikon	D002726	Mike Walker-Canton		X
Total station	Nivo 3M	Nikon	K120467	Out for Repair 8/28/15		X
Total station	Nivo 3M	Nikon	A151846	Phil Odonnell (Beckley)		X
Total station	Nivo 3M	Nikon	A150543	Tyler Riffle	16-Jun	X
Total station	Nivo 3M	Nikon	A152113	Joe Odonnell (VA)	No Date Supplied	X
Total station	Nivo 3M	Nikon	A300613	????????????????????????????		X
Total station	Nivo 3M	Nikon	A151527	????????????????????????????		X
Total station	Nivo 3M	Nikon	A151531	Chris Baker	Needs Calibrated	
Total station	Nivo 3M	Nikon	A152091	Toby Paul (OH)	"New" No Calibration date	
Total station	Nivo 3M	Nikon	A150754	James Howes	16-Jul	X
Total station	Nivo 3M	Nikon	D003432	Chris Dief (PA)	No Date Supplied	X
Total station	Nivo 2M	Nikon	D003479	Cage	16-Aug	X
Total station	Nivo 2M	Nikon	D003488	Beckley Office ( Bob Buffler )	16-Jul	X
Total station	Nivo 2M	Nikon	D003515	Cage	16-Aug	X
Total station	Nivo 2M	Nikon	D003332	David Pratt	15-Dec	X
Total station	ES-103	Topcon	BR0487	Mark Chaffner (MD)	No Date Supplied	
Total station	ES-103	Topcon	BR0442	????????????????????????????		
Total station	ES-103	Topcon	070169	Canton Office	7/15 "Past Due"	
Total station	ES-103	Topcon	070178	Cage		
Total station	GPT 3005LW	Topcon	410975	Beaver Office		
Total station	GPT 3005LW	Topcon	410992	Daniel Boyd (VA)	No Date Supplied	
Total station	GPT 3005LW	Topcon	411296	Josh Oyler (OH)	8/15 "Past Due"	
Total station	GTS-300	Topcon	360283	Fredericksburg Office (VA)	No Date Supplied	
Total station	GTS-605	Topcon	350102	Cage		
Total station	SS0120	Topcon	550120	????????????????????????????		
Total station	GPT 3005LW	Topcon	411182	Scott Whitlock	16-May	
Total station	GPT 3005LW	Topcon	411191	Joseph Lambert	14-Nov	

### HAND-HELD GPS UNITS

DESCRIPTION	MODEL	S/N	ASSIGNMENT	WARRANTY EXP. DATE	FIRMWARE	2015 PU LIST
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GEO-XR6000	89100-80	5222418532	Office	16-Apr	X	X
GEO-XR6000	89100-80	5222418543	Joe Lowther (Office)	16-Apr	X	X
GEO-XR6000	89100-80	5222418551	David Dowd (VA)	16-Apr	X	X
GEO-XR6000	89100-80	5403438467	James Howes	16-Apr	X	X
GEO-XR6000	89100-80	5403438483	Joe Lowther (Office)	16-Apr	X	X
GEO-XR6000	89100-80	5403438485	Fredricksburg Office (VA)	16-Apr	X	X
GEO-XR6000	89100-80	5403438524	Cage	16-Apr	X	X
GEO-XH 6000	88950-00	5112401784	Cage	16-Apr	X	X
GEO-XH 6000	88950-00	5126404960	Office	16-Apr	X	X
GEO-XH 6000	88950-00	5126404991	Environmental	16-Apr	X	X
GEO-XH 6000	88950-00	5207413191	Charleston	16-Apr	X	X
GEO-XH 6000	88950-00	5112401764	Environmental	16-Apr	X	X
GEO-XH 6000	88950-00	5126404990	Beckley Office-Inspection Dept	16-Apr	X	X
GEO-XH 6000	88950-00	5126404971	Inspection Dept	16-Apr	X	X
GEO-7X	88180-04	5351437884	Bridgeport Environmental	16-Apr	X	X
GEO-7X	88180-04	5405439005	Bridgeport Environmental	16-Apr	X	X

**RADIO AMPS**

DESCRIPTION	MODEL	S/N	ASSIGNMENT	Warranty Exp. Date	2015 PU LIST	
TDL-450H	74450-65	14049169	????????????????????	16-Apr	X	
TDL-450H	74450-65	12500223	James Howes	16-Apr	X	
TDL-450H	74450-65	13031212	Cage	16-Apr	X	
TDL-450H	74450-65	12518954	Fredricksburg Office	16-Apr	X	
TDL-450H	74450-65	12500942	John Leary	16-Apr	X	
TDL-450H	74450-65	12507096	MIKEY BROWN	16-Apr	X	
TDL-450H	74450-65	12308337	James Gordon	16-Apr	X	
TDL-450H	74450-65	12209197	Bryon Hudkins	16-Apr	X	
TDL-450H	74450-65	12302159	Eddie Westfall	No Warranty Sheet	X	
TDL-450H	74450-65	14049168	Gregg Goodwin	16-Apr	X	
TDL-450H	74450-65	12518608	Kirk Wilson	16-Apr	X	
TDL-450H	74450-65	12460214	Jonathan Dennison	16-Apr	X	
TDL-450H	74450-65	14332381	Chris Defavo (PA)	No Warranty Sheet	X	
TDL-450H	74450-65	12507172	Cage	16-Apr	X	
TDL-450H	74450-65	12506000	Chris Baker	16-Apr	X	
TDL-450H	74450-65	13031335	Drake Levo	16-Apr	X	
TDL-450H	74450-65	12333338	Cage	16-Apr	X	
TDL-450H	74450-65	14332186	Andrew Middleton	No Warranty Sheet	X	
TDL-450H	74450-65	14332186	Joe Dodson (Va.)	No Warranty Sheet	X	
TDL-450H	74450-65	12209306	Josh Anesty	16-Apr	X	
TDL-450H	74450-65	12506720	Fredricksburg - Daniel Boyd	16-Apr	X	
TDL-450H	74450-65	12312619	Andrew Barns (Damaged in Truck Fu	No Warranty	Removed	Removed
TDL-450H	74450-65	11331847	Jason Barnett	16-Apr	X	
TDL-450H	74450-65	12309323	Paul Turner	16-Apr	X	
TDL-450H	74450-65	12466552	Mike Walker (OH)	16-Apr	X	
TDL-450H	74450-65	12309323	Mike Walker (Ohio)	No Warranty Sheet	X	
TDL-450H	74450-65	12312385	Andy Stull	No Warranty Sheet	X	
TDL-450H	74450-65	12312385	Josh Oyley (OH)	16-Apr	X	
TDL-450H	74450-65	12309323	Tyler Smith	No Warranty	Removed	Removed

**DATA COLLECTORS**

DESCRIPTION	MODEL	S/N	ASSIGNMENT	Warranty Exp. Date	FIRMWARE 5.01	2015 PU LIST
TRIMBLE	TSC2	55A0C46601	????????????????????			
TRIMBLE	TSC2	55B1C52078	????????????????????			
TRIMBLE	TSC2	55B1C57142	????????????????????			
TRIMBLE	TSC3	RS08C0128	????????????????????			
TRIMBLE	TSC3	RG15017909	Kyle Gay	No Warranty	Removed	Removed 4/15
TRIMBLE	TSC3	RS01C08772	Eddie Westfall	16-Apr	X	X
TRIMBLE	TSC3	RS08C0824	James Howes	16-Apr	X	X
TRIMBLE	TSC3	RS0AC02944	Toby Paul (OH)	16-Apr	X	X
TRIMBLE	TSC3	RS0BC03973	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS0CC06243	Bud Bargy	16-Apr	X	X
TRIMBLE	TSC3	RS0FC06676	Beckley Office ( Bob Ruffner )	16-Apr	X	X
TRIMBLE	TSC3	RS0FC06691	Justin Gordon	16-Apr	X	X
TRIMBLE	TSC3	RS0FC07768	Scott Whelock	16-Apr	X	X
TRIMBLE	TSC3	RS0IC08837	Aaron's Office Spar	16-Apr	X	X
TRIMBLE	TSC3	RS0QC13548	Spar Unit	16-Apr	X	X
TRIMBLE	TSC3	RS0TC15365	Fredricksburg Office (VA)	16-Apr	X	X
TRIMBLE	TSC3	RS0UC15829	Jarret Lantz	16-Apr	X	X
TRIMBLE	TSC3	RS13C19156	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS13C19195	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS13C19341	Bryan Hudkins	16-Apr	X	X
TRIMBLE	TSC3	RS16C20878	Kirk Wilson	16-Apr	X	X
TRIMBLE	TSC3	RS17C21230	Oakland (Spare)	16-Apr	X	X
TRIMBLE	TSC3	RS18C22272	Fredricksburg Office (Spare)	16-Apr	X	X
TRIMBLE	TSC3	RS18C22597	Joseph Lowther	16-Apr	X	X
TRIMBLE	TSC3	RS18C22634	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS1JC30814	Jonathan Dennison	16-Apr	X	X
TRIMBLE	TSC3	RS1JE30923	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS1KC31944	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS1QC36477	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS1TC38161	Allegra????????????????	16-Apr	X	X
TRIMBLE	TSC3	RS1TC38272	Jonathan Dennison	16-Apr	X	X
TRIMBLE	TSC3	RS1TC38276	Andrew Middleton	16-Apr	X	X
TRIMBLE	TSC3	RS1TC38491	MIKEY BROWN	16-Apr	X	X
TRIMBLE	TSC3	RS2BC46310	Drake Levo	No Warranty	X	X
TRIMBLE	TSC3	RS2BC46310	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS2BC46310	Cage	16-Apr	X	X
TRIMBLE	TSC2	55A7C45985	????????????????????			
TRIMBLE	TSC2	55B1C57166	????????????????????			
TRIMBLE	TSC3	RS0CC05338	Joseph Lowther ????????????	No Warranty	Removed	Removed 10/14
TRIMBLE	TSC3	RS13C18946	Fredricksburg Office(Va.)	16-Apr	X	X
TRIMBLE	TSC3	RS0AC02360	Rob Lynch	16-Apr	X	X
TRIMBLE	TSC3	RS0FC06724	Cage	16-Apr	X	X
TRIMBLE VX	TSC3 VX	RS17C22069	Gregg Goodwin (VX)	16-Apr	X	X
TRIMBLE	TSC3	RS2BC46472	Chris Defino (PA)	No Warranty	X	X
TRIMBLE	TSC3	RS29C45266	Canton Office	16-Apr	X	X
TRIMBLE	TSC3	RS2PC56916	Joe Dodson (Va.)	16-Apr	X	X
TRIMBLE	TSC3	RS1C30244	Mike Walker (Ohio)	16-Apr	X	X
TRIMBLE	TSC3	RS1MC34499	Andy Stull	No Warranty	X	X
TRIMBLE	TSC3	RS1TC39246	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS0BC03732	Kirk Wilson	16-Apr	X	X
TRIMBLE	TSC3	RS1PA00287	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS1JC30814	Jonathan Dennison	16-Apr	X	X
TRIMBLE	TSC3	RS1TC38093	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS1QC36805	Cage	16-Apr	X	X

TRIMBLE	TSC3	RS2DC47788	Mark Gallagher (Oakland)	16-Apr		X
TRIMBLE	TSC3	RS2DC47759	Jason Garrett	16-Apr	X	X
TRIMBLE	TSC3	RS10C36571	Josh Kniceley	16-Apr	X	X
TRIMBLE	TSC3	RS2CC47323	Joseph Lambert	16-Apr		X
TRIMBLE	TSC3	RS2C52303	John Leary	16-Apr	X	X
TRIMBLE	TSC3	RS2BC46485	Cage (Mac Fulmer)	16-Apr	X	X
TRIMBLE	TSC3	RS27C44156	Drake Levo	16-Apr		X
TRIMBLE	TSC3	RS29C45781	Tyler Riffle	16-Apr	X	X
TRIMBLE	TSC3	RS22C53199	Josh Oyster (Ohio)	16-Apr		X
TRIMBLE	TSC3	RS29C455516	David Boyd (Va.)	16-Apr		X
TRIMBLE	TSC3	RS29C46497	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS08C04145	Canton Office	16-Apr		X
TRIMBLE	TSC3	RS18C37114	Mapping Dept.	16-Apr		X
TRIMBLE	TSC3	RS18C37355	J. Du (BECKLEY)			X
TRIMBLE	TSC3	RS23C42041	Phil Odonell (Beckley)			X
TRIMBLE	TSC3	RS2CC47010	Cage	16-Apr	X	X
TRIMBLE	TSC3	RS2CC46944	????????????????????????????			
TRIMBLE	TSC3	RS27C44085	David Pritt	16-Apr		X
TRIMBLE	TSC3	RS29C45637	Chris Baker	16-Apr	X	X
TRIMBLE	TSC3	RS0FC13441	Graeg Goodwin	16-Apr	X	X
TRIMBLE	TSC3	RS2FC49052	Bram Busdecker	16-Apr		X
TRIMBLE	TSC3	RS08C01028	Beckley Office (Bob Ruffner)	16-Apr		X
TRIMBLE	TSC3	RS26C43612	Aaron Rowe	16-Apr	X	X

**METAL DETECTORS**

DESCRIPTION	MODEL	S/N	ASSIGNMENT	LAST INVENTORY DATE
Schonstedt	GA 52CX	283814	John Leary	16-Apr
Schonstedt	GA 52CX	307129	Chris Baker	16-Apr
Chicago Steel Tape	S0122-5808	297703	Kirk Witten	16-Apr
Schonstedt	GA 52CX	101033032	Eddie Westfall	16-Apr
Schonstedt	GA 52CX	303762	Mike Walker	16-Apr
Schonstedt	GA 52CX	292571	Jesh Oyster	16-Apr
Schonstedt	GA 52CX	313695	Toby Paul	16-Apr
Schonstedt	GA 52CX	281600	Canton Office	16-Apr
Sub-Surface Instruments	ML-1M	6075754	Rob Lynch	16-Apr
Sub-Surface Instruments	ML-1M	10123688	Jarrett Lantz	16-Apr
Schonstedt	GA 52A	313697	Jonathan Dennison	16-Apr
Cst-Berger	Magna Track 100	45081808	Justin Gordon	16-Apr
Dunham & Morrow	DML-200-1R	123906	David Boyd	16-Apr
Schonstedt	GA-52CX	304480	Fredricksburg Office (VA)	16-Apr
Schonstedt	GA-52CX	304479	James Howes	16-Apr
Sub-Surface Instruments	ML-1	10123713	Mikey Brown	16-Apr
Dunham & Morrow	DML-2000		Joseph Lambert	16-Apr
Dunham & Morrow	DML-2000		Scott Whitlock	16-Apr
Schonstedt	GA-52CX		Andy Stull	16-Apr
Schonstedt	GA-52CX	302350	Drake Levo	16-Apr
Schonstedt	GA-52CX	307131	Chris DeFino	16-Apr
Schonstedt	GA-52CX	304477	Mark Gallagher	16-Apr
Schonstedt	GA-52CX	307127	Brynn Hudkins	16-Apr

**OLD DATA COLLECTORS**

DESCRIPTION	MODEL	S/N	ASSIGNMENT	LAST INVENTORY DATE
ALLEGRA'S		36946	Cage	16-Apr

**RADIO DETECTION UNITS**

Description	Model	S/N	Assignment	LAST INVENTORY DATE
SPAR 300		Dog Bone 52081200218	Jarrett Lantz	4/16 Rental
SPAR 300	300RL1G1	Dog Bone 52070200066	Cage	
		Dog Bone 5107020076	Cage	RENTAL
SPAR 300	300RL1G1	Dog Bone 52080400180	Cage	Rental
SPAR 300	300RL1G1	Dog Bone 52080400188	Cage	RENTAL
		Dog Bone 52090400251	Canton (OH)	rental
		Dog Bone 20004100078	Canton (OH)	rental
		Dog Bone 51070200076		
Vivax	Metrotech	spar box 17109090141	cage	Rental
Vivax	Metrotech	spar box 171090600996	cage	
Radio Detection	RD4000T10	Transmitter 11/710-I-6710T1	cage	
Radio Detection	RD4000	Receiver 11/4KRX-151624P0	cage	
Radio Detection	RD4000T10	Transmitter 11/710-I-6738UV	cage	
Radio Detection	RD4000	Receiver 11/4KRX-155088RE	cage	
Vivax	Metrotech	20003100167	Canton (OH)	

**ROVER POLES**

DESCRIPTION	MODEL	S/N	ASSIGNMENT	LAST INVENTORY DATE
THRASHER				
PRISM POLES	THRASHER			
SECO 8' TWIST LOC	SECO 00001		GEORGE MALLOW	7/9/2014
SECO 8' TWIST LOC	SECO 00002		GEORGE MALLOW	7/9/2014
SECO 8' TWIST LOC	SECO 00003		JOHN BRADY	7/18/2014
SECO 8' TWIST LOC	SECO 00004		JOHN BRADY	7/18/2014
PRISM	THRASHER			
SECO PRISM	PRISM 001		GEORGE MALLOW	7/9/2014
SECO PRISM	PRISM 002		GEORGE MALLOW	7/9/2014
SECO PRISM	PRISM 003		JOHN BRADY	7/18/2014
SECO PRISM	PRISM 004		JOHN BRADY	7/18/2014



TRIMBLE GEO 7X		5351437884	PN. 88180-04	IMEI:99000218986772	SERP	7/14/2014	
TRIMBLE GEO 7X		5405439005	PN. 88180-04	IMEI:99000218986644	CAGE		
FIXED TRIPOD	PLI-BASE		5119-01		CAGE		
FIXED TRIPOD	PLI-BASE		5119-02		CAGE		
QUICK CLAMP TRIPOD	BLACK W/ LOGO		60-ALQR120-BPL-01		CAGE		
QUICK CLAMP TRIPOD	BLACK W/ LOGO		60-ALQR120-BPL-02		ED WESTFALL	7/7/2014	
TRIPOD	CST WOOD/FIBERGLASS		60-WDF-20		CAGE		
PRISM POLE	SECO 8'		5500-11		CAGE		
SECO PRISM			6422-02-FLB		CAGE		
BATTERY	INT. RPL CELL	TRIMBLE HPB 450	DCM0035-01		CAGE		
BATTERY	INT. RPL CELL	TRIMBLE HPB 450	DCM0035-02		CAGE		
BATTERY CHARGER	PDLHPB		PCC-A01509-01		CAGE		
BATTERY CHARGER	PDLHPB		PCC-A01509-02		CAGE		
BATTERY BAG	PDLHPB		PCC-A00644-01		CAGE		
BATTERY BAG	PDLHPB		PCC-A00644-02		CAGE		
TDL 450H 5DB GAIN ANT KIT			20130827	ED WESTFALL	RENTAL	7/7/2014	
TDL 450H 5DB GAIN ANT KIT			20140634	JOHN BRADY	RENTAL	7/18/2014	
TDL 450H 5DB GAIN ANT KIT							
TDL 450H 5DB GAIN ANT KIT							
Fixed Height Tripod			20140626	JOHN BRADY	RENTAL	7/18/2014	
Fixed Height Tripod			20140811				
Fixed Height Tripod							
Fixed Height Tripod							
Metal Locators	LASERTECH GA-52Cx	Schonesdet	65234 297703	Bostic	RENTAL		
GEO 6000	ELPHIK ANT		5412116442		RENTAL	REMOVED	REMOVED
	TBC #		1964316479				
			TBC-SA-1867581229	FLS-TBC-ADV-SW-RF	FREDRICKSBURG	EXPIRES MAY 2015	PASSWORD:8709680032665
			TBC-SA-28320786	FLS-TBC-ADV-SW-RF	FREDRICKSBURG	EXPIRES MAY 2015	ASSWORD: 314197375518906

Thrasher Equipment Matrix						
GNSS Equipment						
Description	Model		Options	SN	WARRANTY SHEET	Assignment
R8	Model 3	67250-66		4918170714	X	Cage
R8	Model 3	67250-66		4921173275	X	Cage
R8	Model 3	67250-66		4921173278	X	Cage
R8	Model 3	67250-66		4921173297	X	Cage
R8	Model 3	67250-66		4934400707	x	Cage
R8	Model 3	67250-66		4943404641	X	Cage with unit 5251421600
R8	Model 3	67250-66		4943404643	X	Mike Walker (OH)
R8	Model 3	67250-66		4943404660	X	Cage
R8	Model 3	67250-66		4943404666	X	Cage
R8	Model 3	67250-66		5026435651	X	Adam Cooper (Cage)
R8	Model 3	67250-66		5026435652	X	Cage with unit 5216485800
R8	Model 3	67250-66		5026435653	X	Cage
R8	Model 3	67250-66		5026435682	X	Chris Baker
R8	Model 3	67250-66		5026435701	X	Kirk Wilson
R8	Model 3	67250-66		5026435710	x	????????????????????
R8	Model 3	67250-66		5044453844	X	Johnathon Dennison
R8	Model 3	67250-66		5046455633	x	Scott Whitlock
R8	Model 3	67250-66		5046455635	X	James Howes
R8	Model 3	67250-66		5046455656	X	John Leary
R8	Model 3	67250-66		5046455706	X	Rob Lynch
R8	Model 3	67250-66		5046455934	X	Mikey Brown (CH)
R8	Model 3	67250-66		5047456004	X	Oakland (Spare)
R8	Model 3	67250-66		5106461055	X	Cage
R8	Model 3	67250-66		5106461115	X	Toby Paul (OH)
R8	Model 3	67250-66		5106461136	X	Cage
R8	Model 3	67250-66		5114464687	X	Eddie Westfall
R8	Model 3	67250-66		5126468107	X	Canton Office
R8	Model 3	67250-66		5126468122	X	Rob Lynch
R8	Model 3	67250-66		5139473035	X	Cage
R8	Model 3	67250-66		5152479868	X	Kirk Wilson
R8	Model 3	67250-66		5215485600	X	Cage
R8	Model 3	67250-66		5216485800	X	Cage with unit 5026435652
R8	Model 3	67250-66		5216485819	X	Jarrett Lantz
R8	Model 3	67250-66		5220487390	X	Fredricksburg (Office)
R8	Model 3	67250-66		5220487415	X	Justin Gordon
R8	Model 3	67250-66		5220487748	X	Cage
R8	Model 3	87208-66		5225490460	X	Andrew Middleton
R8	Model 3	67250-66		5226491568	X	Bud Bargy (MD)
R8	Model 3	67250-66		5235494511	X	Bryan Hudkins
R8	Model 3	67250-66		5235494513	X	Cage
R8	Model 3	67250-66		5242498554	X	Oakland (Spare)

R8	Model 3		5243499198	X	David Pritt
R8	Model 3	67250-66	5243499233	X	Jason Garrett
R8	Model 3	67250-66	5243499332	X	Toby Paul (OH)
R8	Model 3		5247417232	X	Joseph Lambert (BE)
R8	Model 3	67250-66	5251421574	X	Cage
R8	Model 3	67250-66	5251421600	X	Cage with unit 49443404641
R8	Model 3		5316433917	x	Phil Odonell (BE)
R8	Model 4		5316434005	x	Cage
R8	Model 3	67250-66	5324438795	x	A. Stull (BE)
R8	Model 3		5335442476	x	Mark W
R8	Model 3		5133470499	x	?????? @ Work Station
R8	Model 4		5220487625	x	David Boyd (VA)
R8	Model 4		5316433917	X	Charleston (Office)
R8	Model 4		5316434313	X	Tyler Riffle
R8	Model 4		5329440601	X	Cage
R8	Model 4		5410457626	X	?????? @ Work Station
R8	Model 4		5411458728	X	Cage
R8	Model 4		5414461761	X	Mark Gallagher (MD)
R8	Model 4		5414461809	X	Mark Gallagher (MD)
R8	Model 4		5414461814	X	Josh Kniceley
R8	Model 4		5414461821	X	Cage
R8	Model 4		5414461847	X	(Mac. Fullmer)@ Work Station
R8	Model 4		5414461849	X	Drake Levo
R8	Model 3		5414462256	No Warranty	Joe Dodson (VA)
R8	Model 4		5414462260	NO WARRANTY	Chris DeFino (PA)
R8	Model 4		5423467764	x	Gregg Goodwin
R8	Model 4		5433475877	x	Josh Oyler (OH)
R8		67250-66	5220487626	NO WARRANTY	Fredricksburg David Boyd
R8	Model 3	67250-66	5215485743	NO WARRANTY	Found in the Cage 7/29/15
R8	Model 4		5329440537	NO WARRANTY	Andy Stull
					Updated w/5.01 Version
					No Warranty Sheet
					On Warranty Sheet &
					Needs Updated w/ 5.01
					No Warranty





Thrasher Equipment Matrix						
GNSS Equipment						
Description	Model		Options	SN	WARRANTY SHEET	Assignment
Trimble GNSS	R10		001-60	5242498180	x	Cage
Trimble GNSS	R10		001-60	5252422269	x	Cage
Trimble GNSS	R10		001-60	5302423131	x	Joseph Lowther
Trimble GNSS	R10		001-60	5302423142	x	Josh Oyler (OH)
Trimble GNSS	R10		001-60	5308426305	x	David Boyd (VA)
Trimble GNSS	R10		001-60	5308426368	x	Jarrett Lantz
Trimble GNSS	R10		001-60	5308426549	x	Tyler Riffle
Trimble GNSS	R10		001-60	5308426566	x	Chris Baker
Trimble GNSS	R10		001-60	5311428820	x	Johnathon Dennison
Trimble GNSS	R10		001-60	5312430283	x	Scott Whitlock
Trimble GNSS	R10		001-60	5312430350	x	Cage
Trimble GNSS	R10		001-60	5312430356	x	Bryan Hudkins
Trimble GNSS	R10		001-60	5313432348	x	Cage
Trimble GNSS	R10		001-60	5313432363	x	Mike Walker (OH)
Trimble GNSS	R10		001-60	5313432433	x	Justin Gordon
Trimble GNSS	R10		001-60	5320436612	x	Mapping Dept.
Trimble GNSS	R10		001-60	5320436619	x	Andrew Middleton
Trimble GNSS	R10		001-60	5320436622	x	Cage
Trimble GNSS	R10		001-60	5322437945	x	Kirk Wilson
Trimble GNSS	R10		001-60	5324438746	x	Eddie Westfall
Trimble GNSS	R10		001-60	5324438761	x	Cage
Trimble GNSS	R10		001-60	5324438795	x	Andy Stull
Trimble GNSS	R10		001-60	5325438838	x	Jason Garrett
Trimble GNSS	R10		001-60	5335442476	x	Mikey Brown (CH)
Trimble GNSS	R10		001-60	5336442889	x	J. Dix (BE)
Trimble GNSS	R10		001-60	5408454953	x	(Mac. Fullmer) @ Work Station
Trimble GNSS	R10		001-60	5408454957	x	Aaron Rawe
Trimble GNSS	R10		001-60	5410456414	x	Scott Whitlock (BE)
Trimble GNSS	R10		001-60	5410458424	x	Joseph Lambert
Trimble GNSS	R10		001-60	5411458547	x	Drake Levo
Trimble GNSS	R10		001-60	5412460054	x	Bud Bargy (MD)
Trimble GNSS	R10		001-60	5413460397	x	Josh Kniceley
Trimble GNSS	R10		001-60	5413460399	x	John Leary
Trimble GNSS	R10		001-60	5413460447	x	Phil Odonell (BE) (Box in Cage)
Trimble GNSS	R10		001-60	5413460789	x	Cage (Adam Cooper)
Trimble GNSS	R10		001-60	5413460795	x	Fredricksburg (Office)
Trimble GNSS	R10		001-60	5430473543	NOT ON WARRANTY	Joe Dodson (VA)
Trimble GNSS	R10		001-60	5242498177	NOT ON WARRANTY	Chris DeFino (PA)
Trimble GNSS	R10		001-60	5435477234	x	Gregg Goodwin

Trimble GNSS	R10	001-60	5406453896	x	Brant Busdecker
Trimble GNSS	R10	001-60	5439479452	x	James Howes
Trimble GNSS	R10	001-60	5412459660	NOT ON WARRANTY	Cage
Trimble GNSS	R10	001-60	5413460395	NOT ON WARRANTY	Cage
Trimble GNSS	R10	001-60	5408454968	NOT ON WARRANTY	David Pritt
				Updated w / 5.01 Version	
				Not on Warranty Sheet	
				On Warranty Sheet &	Needs Updated w/ 5.01
				Out For Repair &	Needs Updated w/ 5.01
				No Warranty	

New Number	Warranty Exp. Ap14
	5.01
	5.01
	5.01
OMNI STAR	16-Apr
OMNI STAR	14-Aug
OMNI STAR	16-Apr
	5.01
	5.01
	16-Apr
OMNI STAR	16-Apr
	BROKEN BATTERY DOOR
	5.01
	5.01
	16-Apr
	5.01
	5.01
	16-Apr
	5.01
	5.01
RENTAL	16-Apr
	16-Apr
	16-Apr
	16-Apr
	16-Apr
	5.01
	5.01
OWN	16-Apr
OWN	16-Apr
	15-May
	16-Apr
	5.01
	16-Apr
NO HEAD ???	16-Apr
	15-Jun
	5.01
	16-Apr
	15-Jun
	5.01





Thrasher Equipment Matrix									
GNSS Equipment									
Description	Make	Model	Options	SN	Assignment	Standard Software	Additional Software	Warranty Exp. Apr. 2015	Updated
Data Collector	Trimble	TSC3		RS1TC38161	Allegra		Roads, Robotic		
Data Collector	Trimble	TSC3		RS01C08772	Eddie Westfall	GS, AS,S,EM,IS,F,I,MP		x	26-Jan-15
Data Collector	Trimble	TSC3		RS01C08837	SPAR-Aaron's Office	GS, AS,S,EM,IS,F,I,MP	Roads, Utility	x	14-Jan-15
Data Collector	Trimble	TSC3		RS08C00824	James Howes		Radio, Utility	x	16-Apr-15
Data Collector	Trimble	TSC3		RS08C01028	Beckley Office ( Bob Ruffner )		Radio, Utility	x	16-Apr-15
Data Collector	Trimble	TSC3		RS0AC02360	Rob Lynch	GS, AS,S,EM,IS,F,I,MP	Radio, Utility	x	16-Apr-15
Data Collector	Trimble	TSC3		RS0AC02944	Toby Paul (OH)			x	
Data Collector	Trimble	TSC3		RS0BC03732	Kirk Wilson		Road, Tunnel, Radio	x	
Data Collector	Trimble	TSC3	x	RS0BC03973	Cage			x	
Data Collector	Trimble	TSC3		RS0BC04145	Canton Office (Ohio)	GS, AS,S,EM,IS,F,I,MP	Radio, Utility	x	
Data Collector	Trimble	TSC3		RS0DC06243	Bud Bary			x	16-Apr-15
Data Collector	Trimble	TSC3		RS0EC06626	Beckley Office ( Bob Ruffner )	GS, AS,S,EM,IS,F,I,MP		x	16-Apr-15
Data Collector	Trimble	TSC3		RS0EC06691	Justin Gordon	GS, AS,S,EM,IS,F,I,MP		x	27-Feb-15
Data Collector	Trimble	TSC3	x	RS0EC06724	Cage			x	
Data Collector	Trimble	TSC3		RS0FC07768	Scott Whitlock	GS, AS,S,EM,IS,F,I,MP		x	16-Apr-15
Data Collector	Trimble	TSC3		RS0PC13041	Gregg Goodwin	GS, AS,S,EM,IS,F,I,MP	Utility	x	
Data Collector	Trimble	TSC3		RS0TC15365	Fredericksburg Office (VA)			x	
Data Collector	Trimble	TSC3		RS0UC15829	Jarrett Lantz	GS, AS,S,EM,IS,F,I,MP	Radio	x	
Data Collector	Trimble	TSC3		RS13C18946	Fredericksburg Office (VA)	GS, AS,S,EM,IS,F,I,MP		x	
Data Collector	Trimble	TSC3		RS13C19156	Cage (Adam Cooper)	GS, AS,S,EM,IS,F,I,MP		x	
Data Collector	Trimble	TSC3		RS13C19195	Cage	GS, AS,S,EM,IS,F,I,MP		x	
Data Collector	Trimble	TSC3		RS13C19341	Bryan Hudkins			x	
Data Collector	Trimble	TSC3		RS16C20828	Kirk Wilson			x	
Data Collector	Trimble	TSC3		RS17C21230	Oakland (Spare)			x	
Data Collector	Trimble	TSC3		RS17C22069	VX Gregg Goodwin	GS, AS,S,EM,IS,F,I,MP		x	27-Feb-15
Data Collector	Trimble	TSC3		RS18C22272	Fredericksburg Office (Spare)	GS, AS,S,EM,IS,F,I,MP		x	
Data Collector	Trimble	TSC3		RS18C22597	Joseph Lowther	GS, AS,S,EM,IS,F,I,MP	Radio	x	13-Mar-15
Data Collector	Trimble	TSC3		RS18C22634	Cage	GS, AS,S,EM,IS,F,I,MP	Radio, Utility	x	
Data Collector	Trimble	TSC3		RS1JC30814	Johnathon Dennison	GS, AS,S,EM,IS,F,I,MP	Radio, Utility	x	4-Feb-15
Data Collector	Trimble	TSC3	x	RS1JC30923	Cage	GS, AS,S,EM,IS,F,I,MP	Radio, Utility, Roads	x	
Data Collector	Trimble	TSC3	x	RS1KC31944	Cage	GS, AS,S,EM,IS,F,I,MP	Utility, Roads	x	
Data Collector	Trimble	TSC3		RS1QC36477	Cage			x	
Data Collector	Trimble	TSC3		RS1QC36571	Josh Knicely	GS, AS,S,EM,IS,F,I,MP	Roads	x	
Data Collector	Trimble	TSC3		RS1QC36805	Cage	GS, AS,S,EM,IS,F,I,MP		x	11-Feb-15
Data Collector	Trimble	TSC3		RS1RC37114	Mapping Dept.	GS, AS,S,EM,IS,MP		x	17-Mar-15
Data Collector	Trimble	TSC3		RS1RC37355	J. Dix (BE)			x	
Data Collector	Trimble	TSC3	x	RS1TC38093	Cage	GS, AS,S,EM,IS,F,I,MP	Radio, Roads	x	14-Jan-15
Data Collector	Trimble	TSC3	x	RS1TC38272	Johnathon Dennison	GS, AS,S,EM,IS,F,I,MP	Radio, Roads	x	16-Apr-15
Data Collector	Trimble	TSC3	x	RS1TC38276	Andrew Middleton		5.01	x	
Data Collector	Trimble	TSC3		RS1TC38491	Mikey Brown (CH)			x	16-Apr-15
Data Collector	Trimble	TSC3		RS23C42041	Phil Odonell (BE)	GS, AS,S,EM,IS,F,I,MP		x	
Data Collector	Trimble	TSC3		RS26C43612	Aaron Rawe	GS, AS,S,EM,IS,F,I,MP	Radio, Roads	x	
Data Collector	Trimble	TSC3		RS27C44085	David Pritt			x	16-Apr-15
Data Collector	Trimble	TSC3		RS27C44156	Drake Levo			x	16-Apr-15
Data Collector	Trimble	TSC3		RS29C45516	David Boyd (VA)	GS, AS,S,EM,IS,F,I,MP		x	16-Apr-15
Data Collector	Trimble	TSC3		RS29C45637	Chris Baker	GS, AS,S,EM,IS,F,I,MP	Utility	x	
Data Collector	Trimble	TSC3		RS29C45781	Tyler Riffle			x	
Data Collector	Trimble	TSC3		RS26C46310	Drake Levo			x	

Data Collector	Trimble	TSC3	RS2BC46472	Chris DeFino (PA)				Not on Warranty	
Data Collector	Trimble		RS2BC46485	Cage (Mac.Fullmer)				x	13-Mar-15
Data Collector	Trimble	TSC3	RS2BC46497	Cage	GS, AS,S,EM,IS,F,I,MP			x	
Data Collector	Trimble		RS29C45266	Canton Office				x	
Data Collector	Trimble	TSC3	RS2CC47010	Cage	GS, AS,S,EM,IS,F,I,MP			x	17-Feb-15
Data Collector	Trimble	TSC3	RS2CC47323	Joseph Lambert	GS, AS,S,EM,IS,F,I,MP			x	16-Apr-15
Data Collector	Trimble	TSC3	RS2DC47759	Jason Garrett				x	
Data Collector	Trimble	TSC3	RS2DC47788	Mark Gallagher (MD)				x	16-Apr-15
Data Collector	Trimble	TSC3	RS2FC49052	Brant Busdecker				x	16-Apr-15
Data Collector	Trimble	TSC3	RS2IC52303	John Leary				x	
Data Collector	Trimble	TSC3	RS2IC53199	Josh Oyler (OH)	10/14/2014			x	
Data Collector	Trimble	TSC3	RS2PC56916	Joe Dodson (VA)				x	16-Apr-15
Data Collector	Trimble	TSC3	RS1IC30244	Mike Walker (OH)				x	
Data Collector	Trimble	TSC3	RSP1A00287	Cage	GS, AS,S,EM,IS,F,I,MP	Roads		x	
Data Collector	Trimble	TSC3	RS1TC39246	Cage				x	
Data Collector	Trimble	TSC3	RS1MC33499	Andy Stull				Not on Warranty	16-Apr
Data Collector	Trimble	TSC3	RSP1A00357	MISSING ????????????????????					
Data Collector	Trimble	TSC3	RSP1A00549						
Data Collector	Trimble	TSC2	SS24A16373						
Data Collector	Trimble	TSC2	SS57C16727						
Data Collector	Trimble	TSC2	SSA0C46605						
Data Collector	Trimble	TSC2	SSA7C45985						
Data Collector	Trimble	TSC2	SSA9C46601						
Data Collector	Trimble	TSC2	SSB1C57078						
Data Collector	Trimble	TSC2	SSB1C57142						
Data Collector	Trimble	TSC2	SSB1C57166						
				Updated w/ 5.01 Version					
				Not on Warranty Sheet					
				On Warranty Sheet &	Need Updated w/ 5.01				
				Out For Repair	Need Updated w/ 5.01				
				No Warranty					





Thrasher Equipment Matrix						
GNSS Equipment						
Description	Model	Options	SN	WARRANTY SHEET 2015	Assignment	
GEO-XR 6000	89100-80		5222418504	X	Cage	
GEO-XR6000	89100-80		5222418551	X	David Boyd	
GEO-XR6000	89100-80		5222418543	x	J.Pruett/Lowther's Office	
GEO-XR6000	89100-80		5403438483	x	J.Dennison/Lowther's Office	
GEO-XR6000	89100-80		5403438485	x	Fredricksburg Office	
GEO-XR6000	89100-80		5403438524	x	Cage	
GEO-XR6000	89100-80		5403438682	X	Cage	
GEO-XR6000	89100-80		5403438487	X	James Howes	
GEO-XH 6000	88950-00		5112401764	X	Environmental	
GEO-XH	88950-00		5126404990	X	Beckley Office-Inspections	
GEO-XH	88950-00		5126404991	X	ENVIRONMENTAL	
GEO-XH			5207413191	X	CHARLESTON	
GEO-XH			5126404971	X	Inspections	
TRIMBLE GEO 7X	88180-04		5351437884	X	BRIDGEPORT ENVIROMENTAL	
TRIMBLE GEO 7X	88180-04		5405439005	X	BRIDGEPORT ENVIROMENTAL	
Seafloor Intuicom	Sonarmite RTK Bridge	MILSPEC	SMIL060513 4076550		Cage Cage	

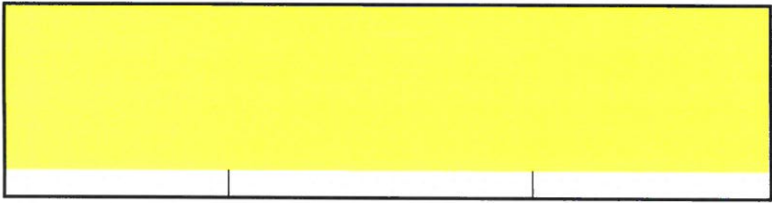
Antenna	SN	Warranty Exp. Ap14
Zephyr Model 2 5.01	1212118286	X
Zephyr Model 2	1912118603	X
Zephyr Model 2 5.01		
Zephyr Model 2	2212756499	
Zephyr Model 2	2012756928	
Zephyr Model 2	8000011256	
Zephyr Model 2 5.01		
TEI-GIS-1		X
TEI-GIS-2		X
7/14/2014		15-Mar
		15-Mar
	x	

Thrasher Equipment Matrix						
GNSS Equipment						
Description	Model		Options	SN	WARRANTY SHEET	Assignment
<b>Radio Amps</b>						
Trimble	TDL 450H	74450-65		11231847	X	Jason Garrett
Trimble	TDL 450H	74450-65		12203925	X	Jarrett Lantz
Trimble	TDL 450H			12203947	X	Bryan Hudkins
Trimble	TDL 450H	74450-65		12260006	X	Josh Knicaly
Trimble	TDL 450H	74450-65		12312385	X	Josh Oyler (OH)
Trimble	TDL 450H	74450-65		12312619		Found (In Fire)
Trimble	TDL 450H	74450-65		12466214	X	Jonathan Dennison
Trimble	TDL 450H	74450-65		12466552	X	Mike Walker (OH)
Trimble	TDL 450H	74450-65		12504223	X	James Howes
Trimble	TDL 450H			12504347	X	Justin Gordon
Trimble	TDL 450H	74450-65		12504390	X	Chris Baker
Trimble	TDL 450H	74450-65		12506720	X	David Boyd (VA)
Trimble	TDL 450H	74450-65		12506762	X	Mark Gallagher
Trimble	TDL 450H			12506942	X	John Leary
Trimble	TDL 450H			12506954		Tyler Riffle
Trimble	TDL 450H			12507066	X	Mikey Brown (CH)
Trimble	TDL 450H			12507159	X	Eddie Westfall
Trimble	TDL 450H	74450-65		12507172	X	Cage
Trimble	TDL 450H	7445-65		12518338	X	Cage
Trimble	TDL 450H			12518646	X	Kirk Wilson
Trimble	TDL 450H			12518904	X	Fredricksburg Office (VA)
Trimble	TDL 450H			13031155	X	Drake Levo
Trimble	TDL 450H			13031212	X	Cage
Trimble	TDL 450H			14049168	X	Goodwin
Trimble	TDL 450H			14049169	X	Cage
Trimble	TDL 450H			14332181	x	Chris DeFino
Trimble	TDL 450H			14332184	X	Joe Dodson (VA)
Trimble	TDL 450H			14332186	X	Andrew Middleton
Trimble	trimmark3			4438138264		Cage
Trimble	TDL 450H			12518739		Andy Stull
Trimble	HPB-450H	PDL4535		09085126		Cage
Trimble	HPB-450H	PDL4535		09085126		Cage
Trimble	HPB-450H	PDL4535		09366322		Cage
Trimble	HPB450	PDL4535		09366322		Cage
Trimble	HPB-450H	PDL4535		11126523	X	Cage
Trimble	HPB450	PDL4535		11126523	X	Cage
Trimble	HPB450	PDL4535		11147598	X	Cage
Trimble	HPB450	PDL4535		11200419	X	Cage
Trimble	HPB-450H	PDL4535		0931 6323		Cage
Trimble	HPB-450H	PDL4535		1024 8535		Cage



Trimble	HPB-450H	PDL4535	1049 5861						
Trimble	HPB-450H	PDL4535	1114 7598				X		Cage
Trimble	HPB-450H	PDL4535	1116 6520						Cage
Trimble	HPB-450H	PDL4535	1120 0419				X		Cage
	HPB-450H	PDL4535							Cage
	HPB-450H	PDL4535							Cage
?	?	?				10302529	X		?





Thrasher Equipment Matrix						
GNSS Equipment						
Description	Model		Options	SN	WARRANTY SHEET	Assignment
<b>RADIO DETECTION UNITS</b>						
Description	Model		Options	SN		Assignment
Radio Detection	RD4000	Receiver		11/4KRX-151624P0		FREDRICKSBURG
Radio Detection	RD4000	Receiver		11/4KRX-155088RE		K. Wilson
Radio Detection	RD4000T10	Transmitter		11/T10-I-6710TJ		FREDRICKSBURG
Radio Detection	RD4000T10	Transmitter		11/T10-I-6738UV		K. Wilson
SPAR 300	300RL1G1	dog bone		5107020075		Cage
SPAR 300	300RL1G1	dog bone		51070200076		Cage
SPAR 300	300RL1G1	dog bone		52070200066		Klayt
SPAR 300	300RL1G1	dog bone		52080400180		Cage
SPAR 300	300RL1G1	dog bone		52080400188		Cage
SPAR 300	300RL1G1	dog bone		52081200218		Jarrett Lantz
SPAR 300	300RL1G1	dog bone		52090400251		canton
Vivax	Metrotech	spar box		20003100167		Canton Office
Vivax	Metrotech	spar box		170712000218		J. Lantz
Vivax	Metrotech	spar box		171090600996		Cage
Vivax	Metrotech	spar box		171090600998		Klayt
Vivax	Metrotech	spar box		171090901741		Cage
	LASERTECH			65234		

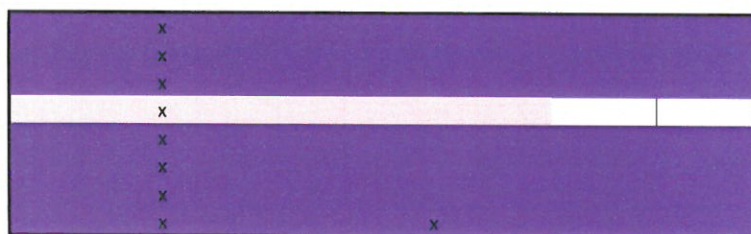
New Number		Warranty Exp. Ap14
	x	
	x	
	x	
	16-Apr	

Thrasher Equipment Matrix						
GNSS Equipment						
Description	Model		Warranty	SN	Assignment	Calibration Date Due
Leica	TC303	TS		681755	Cage	Sep-15
Leica	TC403	TS		756722	Cage	Jul-16
Leica	TC403	TS		757668	Bud Bargy (loaner)	Apr-16
Leica	TC405	TS		842490		
Leica	TC405	TS		843632	Kirk Wilson	Jun-16
Leica	TC405	TS		856203	Gregg Goodwin	Jun-16
Leica	TC703	TS		647516	Justin Gordon	Apr-16
Leica	TCR403	TS		698965	John Leary	Sep-15
Leica	TCR405	TS		698960	Out for Repair 8/28/15	Apr-16
Leica	TS-02	TS		1322649	Mikey Brown	Apr-15
Leica	TS-02	TS		1322703	Cage	Apr-16
Leica	TS-02	TS		1322739	Cage	Apr-16
Leica	TS-02	TS		1322785	Eddie Westfall	Jun-16
Nikon	Nivo 2M	TS	x	D093332	David Pritt	Dec-15
Nikon	Nivo 2M	TS	x	D093432	Chris DeFino (PA)	unk
Nikon	Nivo 2M	TS	x	D093438	Beckley Office (Bob Ruffner)	Jul-15
Nikon	Nivo 2M	TS	x	D093479	Cage	Aug-16
Nikon	Nivo 3M	TS	x	A150543	Tyler Riffle	Jun-15
Nikon	Nivo 3M	TS	x	A150754	Jimbo Howes	Apr-15
Nikon	Nivo 3M	TS	x	A151353	Cage	Sep-16
Nikon	Nivo 3M	TS	x	A151846	Phil Odonell (BE)	May-15
Nikon	Nivo 3M	TS	x	A152113	Joe Dodson (VA)	Sep-15
Nikon	Nivo 3M	TS	x	A152118	Cage	Jun-15
Nikon	Nivo 3M	TS	x	C120467	Out for Repair 8/28/15	
Nikon	Nivo 3m	TS	x	A152120	Drake Levo	May-15
Nikon	Nivo 3m	TS	x	A152091	Toby Paul (OH)	
Nikon	Nivo3m	TS	x	A151531	cage	unk
Nikon	Nivo3m	TS	x	A151527	Cage	unk
Nikon	Nivo3m	TS	x	A300613	Cage	
Nikon	Nivo 2m	TS	x	D093515	Cage	Aug-16
Nikon	Nivo 3M	TS	x	D002726	Mike Walker (OH)	May-15
Topcon	ES-103	TS		BR0437	Mark Gallegher	unk
Topcon	ES-103	TS		BR0442		
Topcon	ES-103	TS		GY0169	Mike Walker (OH)	
Topcon	ES-103	TS		GY0173	Cage "Suppose to go to Oakland"	
Topcon	GPT3005LW	TS		4J0692	David Boyd (VA)	unk
Topcon	GPT3005LW	TS		4J1296	Josh Oylar	Aug-15
Topcon	GTS-300	TS		NV0351	Fredricksburg Office (VA)	unk
Topcon	GPT3005LW	TS		4J0975	Beaver Office	May-14
Topcon	GPT3005LW	TS		4J1191	Joseph Lambert	14-Nov
Topcon	GPT3005LW	TS		4J1182	Scott Whitlock	16-May

Trimble	S3	Robotic	x	91410800	Jarrett Lantz	Aug-15
Trimble	S3	Robotic	x	91411109	Rob Lynch	May-15
Trimble	S3	Robotic	x	91411222	Jonathan Dennison	Sep-15
Trimble	S3	Robotic	x	91411253	Canton	
Trimble	S3	Robotic	x	91411678	Drake Levo	Aug-15
Trimble	S6	Robotic		93010708	Andy Stull	16-Jun
Trimble	S6	Robotic	x	93310269	Fredricksburg Office (VA)	Nov-15
Trimble	VX	Robotic	x	93710432	Gregg Goodwin	Aug-15







Thrasher Equipment Matrix						
Optical Instruments						
Description	Model	Make	Options	SN		Assignment
Level	DNA03	Leica		344903		Fredricksburg Office (VA)
Level	NA730	Leica		5083760		Mike Walker (OH)
Level	NA730	Leica		5368775		Josh Oyler (OH)
Level	NA730	Leica		5419284		CAGE
Level	AE-7	Nikon		249205		
Level	AP-3	Nikon		508124		Bryan Hudkins
Level	B21	SOKKIA		416773		Toby Paul
Level	AT-B3	Topcon		486363		
Level	AT-B3	Topcon		N01532		Jarrett Lantz
Level	AT-B3	Topcon		N01548		Aaron Rawe
Level	AT-B3	Topcon		N01549		Rob Lynch
Level	AT-B3	Topcon		N01551		Kirk Wilson
Level	AT-B3	Topcon		N03400		Mikey Brown (CH)
Level	AT-B3	Topcon		N03435		Scott Pacifico
Level	AT-B4	Topcon		N57833		Robert Stark
Level	AT-B4	Topcon		X57866		
Level	AT-F2	Topcon		R10812		Andrew Middleton
Level	AT-G3	Topcon		487284		Eddie Westfall
Level	AT-S3	Topcon		D177		Joseph Lambert
Level	AT-G3	Topcon		487284		
Level	DINI 12	Trimble		7000981		Rob Lynch
Level	AP8	Nikon		510890		James Howes
Level	AP8	Nikon		510886		Cage
Level	AP8	Nikon		510884		Jonathon Dennison
Level	AP8	Nikon		510786		Andrew Middleton



Thrasher Equipment Matrix						
GNSS Equipment						
Description	Model	Options	SN	WARRANTY SHEET	Assignment	
GEO-XR 6000	89100-80		5222418504	XX	Cage	
GEO-XR6000	89100-80		5222418532	XX	Office	
GEO-XR6000	89100-80		5222418543	XX	Office	
GEO-XR6000	89100-80	x	5222418551	XX	David Boyd (VA)	
GEO-XR6000	89100-80		5403438487		A. Middleton	
GEO-XR6000	89100-80		5403438483		D. Boyd (VA)	
GEO-XR6000	89100-80		5403438485		J. Howes	
GEO-XR6000	89100-80		5403438524		Cage	
GEO-XR6000	89100-80		5403438682		Cage	
GEO-XH 6000	88950-00		5112401784		Environmental	
GEO-XH	88950-00		5126404960	X	OFFICE	
GEO-XH	88950-00		5126404991	X	ENVIRONMENTAL	
GEO-XH	88950-00		5207413191		CHARLESTON	
GEOXH	88950-00		5112401764			
ZEPHYR ANT	57970-00		5412118442			
TRIMBLE GEO 7X	88180-04		5351437884	IMEI:99000218986772	SERP	
TRIMBLE GEO 7X	88180-04		5405439005	IMEI:99000218986644	Cage	
Seafloor	Sonarmite	MILSPEC	SMIL060513		Cage	
Intuicom	RTK Bridge		4076550		Cage	
Metal Locators	GA-52Cx	Schonesdet	283814		Repair	
Metal Locators	GA-52Cx	Schonesdet	297703		RAWE	
Metal Locators	GA-52Cx	Schonesdet	304480		Fredricksburg	
Metal Locators	GA-52Cx	Schonesdet	306738		Oakland	
Metal Locators	GA-52Cx	Schonesdet	307127		B. Hudkins	
Metal Locators	GA-52Cx	Schonesdet	307129		Baker	
Metal Locators	GA-52Cx	Schonesdet	307131		C. DeFino (PA)	
Metal Locators	GA-52Cx	Schonesdet	307132		G. Goodwin	
Metal Locators	GA-52Cx	Schonesdet			A. Schrader	
Metal Locators	GA-52Cx	Schonesdet			J. Howes	
Metal Locators	GA-52Cx	Schonesdet			K. Wilson	
Metal Locators	GA-52Cx	Schonesdet			M. Gallagher	
Metal Locators	GA-52Cx	Schonesdet	313695		C. Whitacre (OH)	
Metal Locators	GA-52Cx	Schonesdet	313696		C. Mason (OH)	
Metal Locators	GA-52Cx	Schonesdet	313697		J. Dennison	
Metal Locators	GA-52Cx	Schonesdet	292571		S. Pacifico	

Metal Locators	GA-52Cx	Schonesdet	303672		M. Walker (OH)
Metal Locators	GA-52Cx	Schonesdet	292571		J. Oyler (OH)
Metal Locators	GA-52Cx	Schonesdet	313695		T. Paul (OH)
Metal Locators	GA-52Cx	Schonesdet	281600		L.Dillsworth (OH)
Clinometer	PM-5/SPC OPTI	Suunto	14281774		A. Cooper
Clinometer	PM-5/SPC OPTI	Suunto	14281772		OFFICE
Clinometer	PM-5/SPC OPTI	Suunto	14076328		R. Haveron
Clinometer	PM-5/SPC OPTI	Suunto	14281768		G. Goodwin
	TBC #		1964316479		
			TBC-SA-1867581229	EWLS-TBC-ADV-SW-RNST	FREDRICKSBURG
			TBC-SA-28320786	EWLS-TBC-ADV-SW-RNST	FREDRICKSBURG



	w/ leather case	
	w/ leather case	
	w/ leather case	
	w/ leather case	
EXPIRES MAY 2015	PASSWORD:8709680032665	
EXPIRES MAY 2015	PASSWORD: 314197375518906	

**WV VRS - ROVER OPTIONS**

RTK VRS(CMR)

VECTORS

ELEV MASK-10 DEGREES

PDOP MASK-6.0

**ANTENNA**

R-10 OR R-8 INTERNAL

MEASURE TO BOTTOM OF ANTENNA MOUNT ANTENNA HEIGHT- 6.56 6.562 or R10 Bottom of quick release

GNSS SIGNAL TRACKING-CHECK MARK GPS L2C AND GLONASS

**ROVER RADIO**

INTERNET CONNECTION GNSS CONTACT-WV VRS TAP ARROW TO PUT IN IP ADDRESS

Name WV VRS

Network connection  Wi-Fi,ActiveSync

NTRIP Configuration

Use RTX (TGIP) No

Use NTRIP Yes

Use NTRIP v1.0: No

Use proxy server:No

Connect directly to Mountpoint: No

NTRIP username:TE\_1 thru 25 you choose

NTRIP password: 1234

IP address: 184.19.151.56

IP Port:2101

Send user Identity info: No



BASE OPTIONS

SURVEY TYPE-RTK&INFILL

BROADCAST FORMAT-CMRX

LOGGING DEVICE-RECEIVER

LOGGING INTERVAL-2SECS

ELV MAK-10 DEGREES

ANTENNA-R8GNSS/SPS88X

MEASURE TO BOTTOM OF ANTENNA MOUNT

GNSS SIGNAL TRACKING CHECK MARK GPS L2C AND GLONASS

BASE RADIO

TYPE-RECEIVER INTERNAL

SURVEY TYPE-FASTSTATIC

LOGGING DEVICE-CONTROLLER

LOGGING INTERVAL-1 SEC

ELEV MASK-10 DEGREES

PDOP MASK-6.0

ANTENNA-R-10 OR R-8 (DEPENDS ON UNIT)

MEASURE TO BOTT OF QUICK RELEASE OR ANTENNA MOUNT( AGAIN DEPENDS ON UNIT)

6.562

GNSS SIGNAL TRACKING- CHECK MARK GPS L2C AND GLONASS

ROVER OPTIONS

SURVEY TYPE-RTK      BROADCAST FORMAT-CMRX

STATION INDEX ANY

SATELITE DIFF -OFF

ELEV MASK-10 DEGREES

PDOP MASK-6.0

ANTENNA TYPE -R10 INTERNAL OR R-8

MEASURE TO BOTT QUICK RELEASE OR BOTT ANTENNA MOUNT (DEPENDS ON UNIT)

6.562

GNSS SIGNAL TRACKING CHECK MARK L2C AND GLONASS

ROVER RADIO

RECEIVER INTERNAL

METHOD-TRIMBLE 450/900

BASE OPTIONS

SURVEY TYPE-RTK      BROADCAST FORMAT-CMRX

STATION INDEX

ELEV MASK-10 DEGREES

ANTENNA

TYPE=R8GNSS/SPS88X

MEASURE TO BOTT ANTENNA MOUNT

GNSS SIGNAL TRACKING CHECK MARK GPS L2C AND GLONASS

BASE RADIO

TYPE-INTERNAL

METHOD-TRIMBLE450/900

ROVER OPTIONS

SURVEY TYPE-RTK      BROADCAST-CMRX

BASE INDEX ANY

ELEV MASK 10 DEGREES

PDOP 6.0

ANTENNA- R-10 INTERNAL OR R-8 INTERNAL DEPENDING ON UNIT

MEASURE TO BOTT QUICK RELEASE OR ANTENNA MOUNT

GNSS SIGNAL TRACKING CHECK MARK L2C AND GLONASS

ROVER RADIO

TYPE-RECEIVER INTERNAL

METHOD-TRIMBLE 450/900

Topcon	GTS-605	TS	SS0120	Cage		
Trimble GNSS	R10	001-60	5220487390	Fredricksburg		
Trimble GNSS	90909-61		5320436678	CAGE		
Trimble GNSS	R10	001-60	5408454968	x		
Trimble GNSS	R10	001-60	5413460395	x		
Data Collector	Trimble	TSC3	RG15017909			
Data Collector	Trimble	TSC3	RS0CC05338			x
Data Collector	Trimble	TSC3	RS0QC13548	SPAR		
R8	Model 3	67250-66	5152479840		???	
R8	Model 3	67250-66	5215485599		???	
R8	Model 3	67250-66	5220487625		???	
R7	Model 4		4916K34898		Cage	
R8	Model 4		510xxxx1000		Cage	#####
Trimble	TDL 450H		12506954	X		
GEO-XR6000	89100-80		5222418532	X	Office	TEI-GEO-1
GEO-XR6000	89100-80		5222418543	X	Office	TEI-GEO-2
GEO-XR6000	89100-80		5403438487	X	Office	TEI-GEO-2

[Yellow bar]

15-Mar  
15-Jun

[Light grey bar]

X  
X

X

[Light grey bar]

14-Aug

X  
X  
X

TYPE OF LIC LICENSE NUMBER ASSIGNED WARRANTY

HARDWARE 894393168 RAWE X  
17661614 WOLF X  
329878216 LOWTHER X  
662117807 Canton X  
1867581229 OGRIS X  
1230549673 HOWES X  
1311063987 MIDDLETON X  
1964316479 ALLEGRA X  
28320786 Richmond X  
1296802387 DESK X  
94440462 Semple X  
1652903865 DESK X

NETWORK 337112132242 HYMAN  
371072472028 RUFFNER X  
333112132242 OHIO

LIMITED

ADVANCED

933396851 M.I.A  
977651054 M.I.A

ADVANCED  
ADVANCED



Calibration Protocol  
DMC IIe 230 – 23522



Camera Calibration Certificate  
No: DMC IIe 230 – 23522



For

**Richard Crouse & Associates**

467 Aviation Way  
Frederick, MD 21701

USA

Camera: DMC Ile 230  
Manufacturer: Z/I Imaging GmbH, D-73431 Aalen, Germany  
Reference: PAN  
Serial Number: 00123118 (PAN Head)  
Date of Calibration: 20. November 2014  
Date of Report: 26. November 2014  
Number of Pages: 43

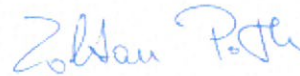
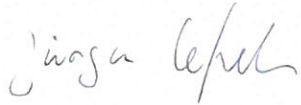
---

Calibration performed at: Carl Zeiss Jena, Carl-Zeiss-Promenade 10, 07745 Jena, Germany.

This camera system is certified by Z/I Imaging and is fully functional within its specifications and tolerances.

Date of Calibration: November 2014

Date of Certification: November 2014



Jürgen Hefe, Senior Software Developer

Dipl.Ing. Zoltan Poth, Workflow Support Engineer

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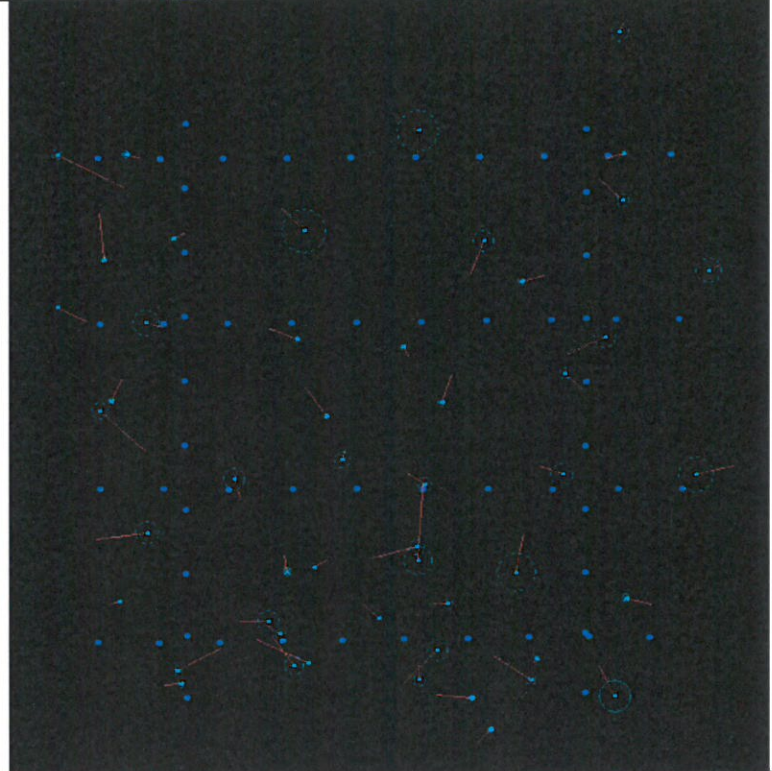


## Camera Serial Numbers and Burn-In flight

Camera Head	Serial Number	Calib. Date
PAN (reference)	00123118	20.11.2014
MS1 (NIR)	00118804	20.11.2014
MS2 (Blue)	00124736	20.11.2014
MS3 (Red)	00124693	20.11.2014
MS4 (Green)	00124739	20.11.2014

Burn-In flight performed: 03. October 2014

### Test block configuration

	Photo Scale	1:9239.1
	Flying Height [m]	850 AGL
	Flying Altitude [m]	1300 AMSL
	Run-Spacing [m]	419.2
	Base-Length [m]	210.2
	Number of Exposures	55
	Side-lap [%]	70
	End-lap [%]	50
	Terrain Height [m]	450
	Number of strips	6
	Photos in one strip	2 x 9 N-S 4 x 9 W-E
	Photos Used	60
	Control Points Used	6
	Check Points Used	44
	GSD [cm]	5

## Aerial triangulation statistic results:

<b>Whole Block Sigma relative :</b>	<b>1.903 <math>\mu\text{m}</math></b>
<b>Whole Block Sigma absolute :</b>	<b>1.689 <math>\mu\text{m}</math></b>

**Photo Triangulation Results**

Summary Stats | Photo Stats | Object Stats | Point Stats | Exterior Orientation | GPS | INS | Self-Calibration

Parameter	X/...	Y/Phi	Z/K...	XY
RMS Control	0.011	0.008	0.008	0.010
RMS Check	0.016	0.015	0.029	0.015
RMS Limits	0.030	0.030	0.050	
Max Ground Residual	0.016	0.018	0.012	
Residual Limits	0.050	0.050	0.070	
Mean Std Dev Object				
RMS Photo Position				
RMS Photo Attitude				
Mean Std Dev Photo Po...				
Mean Std Dev Photo Atti...				

**Key Statistics**

Sigma: 1.7  $\mu\text{m}$

RMS Image (x, y): 1.6, 1.3  $\mu\text{m}$

Number of iterations: 2

Degrees of Freedom: 46089

Gross Image Blunders: 0

Gross Control Blunders: 0

Image Blunders: 0

Solution Status: Solution Successful.

<p><b>Current Count</b></p> <p>Control Points Used: 6</p> <p>Check Points Used: 44</p> <p>Photos Used: 60</p> <p>Photos Not Used: 0</p> <p>Image Points Used: 31185</p>	<p><b>Cameras used: (1)</b></p> <table border="1"> <thead> <tr> <th>Camera Id</th> <th>Len...</th> <th>Grids</th> </tr> </thead> <tbody> <tr> <td>DMC_II_230</td> <td>Off</td> <td>Off</td> </tr> </tbody> </table>	Camera Id	Len...	Grids	DMC_II_230	Off	Off	<p><b>Project Settings</b></p> <p>Linear: Meters    Refraction: Off</p> <p>Angular: Degrees    Curvature: Off</p> <p>Deutsche Hauptdreiecksnetz - Gauss-Kruger (3-degree) (m)</p>
Camera Id	Len...	Grids						
DMC_II_230	Off	Off						

Options...   Control...   Groups...   Reports...   Exterior Orientation...

Compute   Apply   Reset   Graphics...   OK   Cancel   Help

The results of the aerial triangulation were generated with ImageStation Automatic Triangulation (ISAT), Version 2014, from Intergraph Z/I Imaging. The maximum RMS in check points is  $\leq 0.5$  GSD in x,y and  $\leq 0.7$  GSD in z.

Aerial Triangulation performed by



Dipl. Ing. Z. Poth

26.11.2014

Date

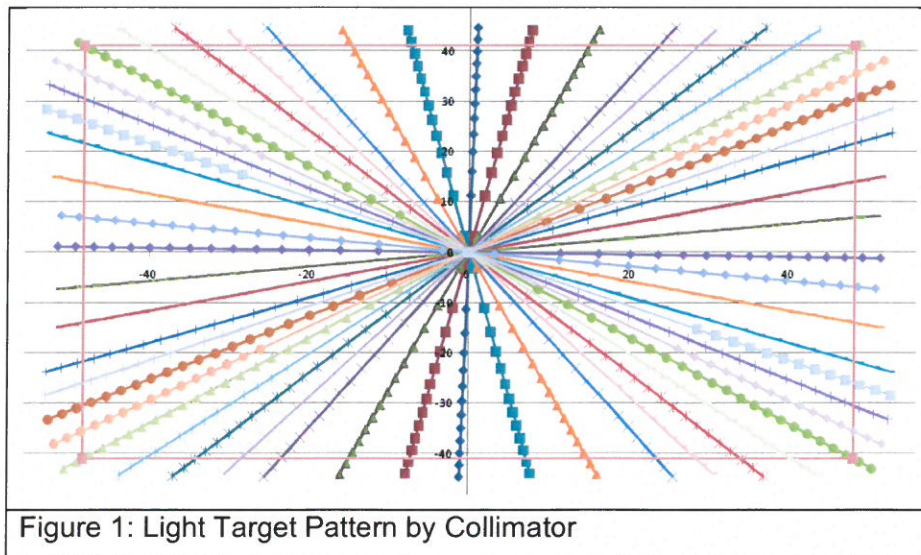
## Geometric Calibration

The output image geometry is based on the Pan Camera head (reference head = master camera). All other camera heads are registered and aligned to this head. Aerial triangulation checks overall system performance based on.

### Output image

Reference Camera	PAN	
Serial Number	00123118	
Number of rows/columns [pixels]	15552 x 14144	
Pixel Size [ $\mu\text{m}$ ]	5.600 x 5.600	
Image Size [mm]	87.0912 x 79.2064	
Focal Length [mm]	92.0064 mm	+ /- 0.002 mm
Principal Point [mm]	X= 0.0005 mm Y= -0.0032 mm	+ /- 0.002 mm

The geometric calibration takes place at Carl Zeiss Jena on a certified test stand. More than 800 “light targets”, projected on 28 lines that are distributed diagonally on the focal plane, are automatically measured by finding their centers light with a precision of less than 1/10 of a pixel. The light targets are projected from the “infinity” by using a collimator (Figure 1).



# Geometric Calibration

## Image Residuals

Figure 2 shows the image residuals, split in radial and tangential directions after the calibration adjustment. The maximum residuals are less than or equal to 1.5 microns and the RMSE values are below 0.5 microns.

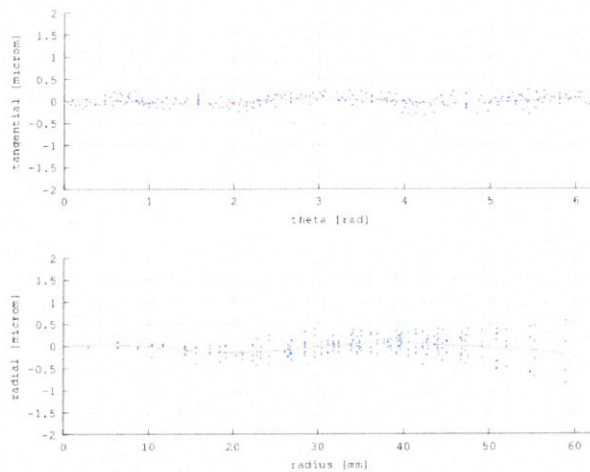


Figure 2: Tangential/Radial Distortion Residuals

Figure 3 shows the 2-D plot of the image residuals in mm.

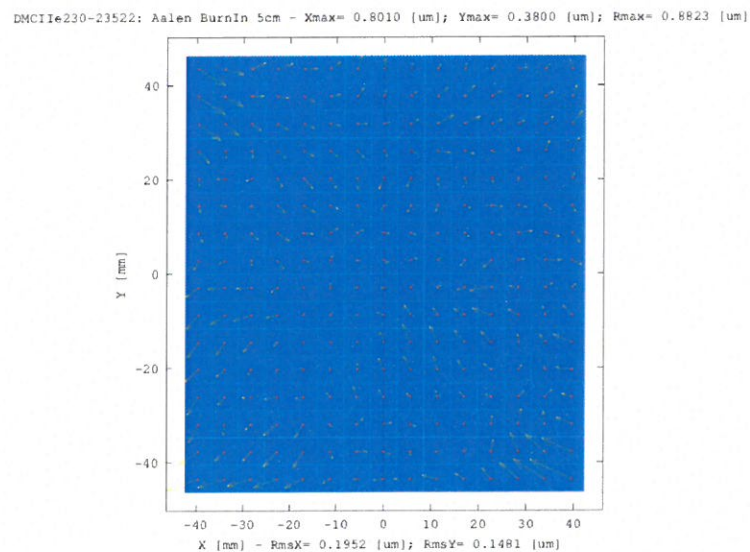
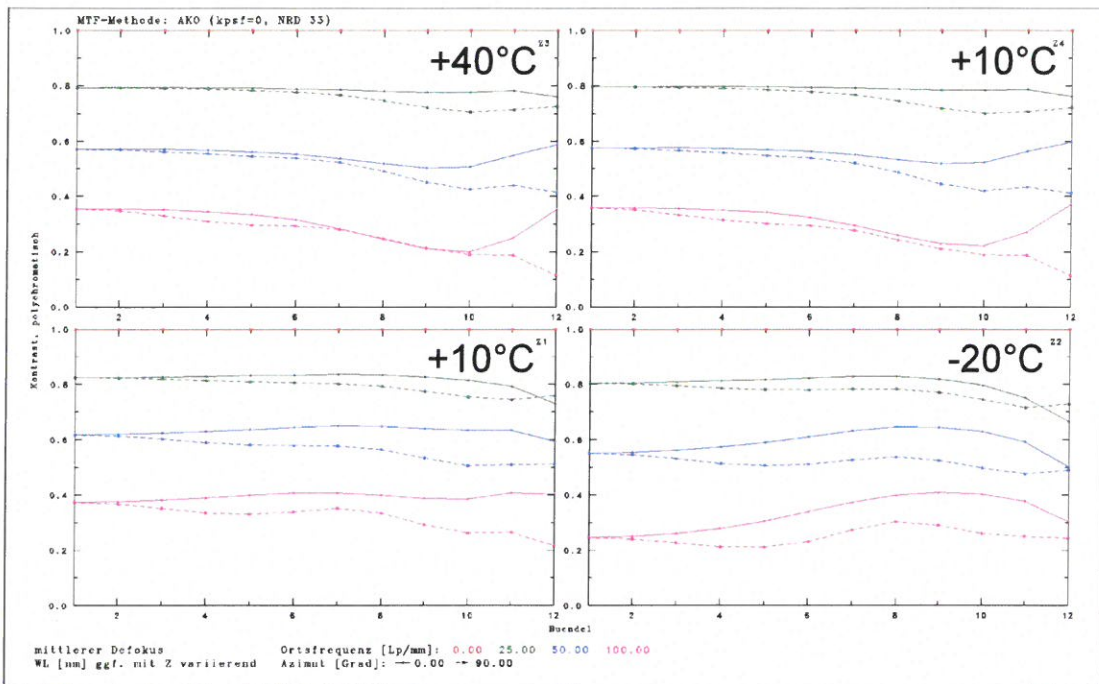


Figure 3: 2-D Image Residuals.  
RMS < 0.20 um (maximum 0.88 microns)

## Optical System

### Modulation Transfer Function, MTF of PAN Camera (Reference)

DMC IIe PAN – MTF Polychromatic F/5.6 ; 92 mm – Temperature Stability

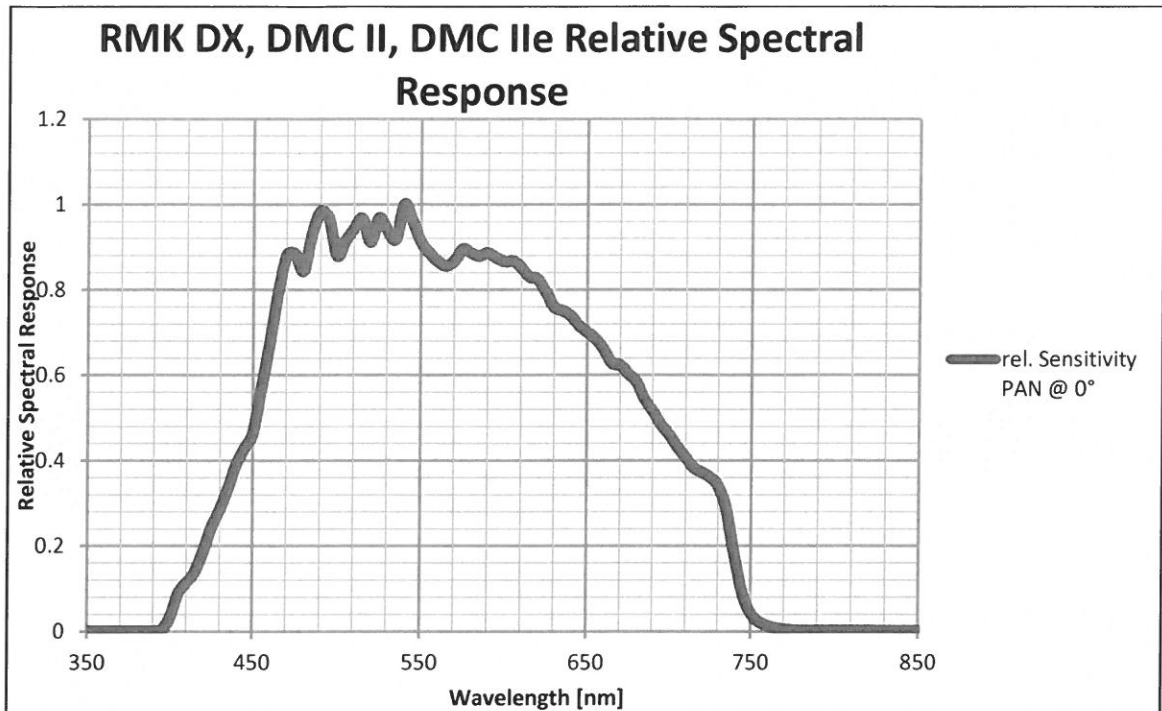


The MTF measurement is camera type specific and shows variation of the MTF within the specified temperature range.

This is a camera type specific measurement.

## Radiometric Calibration

### Sensitivity of PAN camera (Reference)



The sensitivity shows the spectral response curve of the single camera head including the optical system (optics, filter) and the sensor response. The DMC IIe 250 is calibrated with respect to the absolute spectrometer. This allows computing pixel radiance values from pixels digital numbers and is a camera type specific calibration.

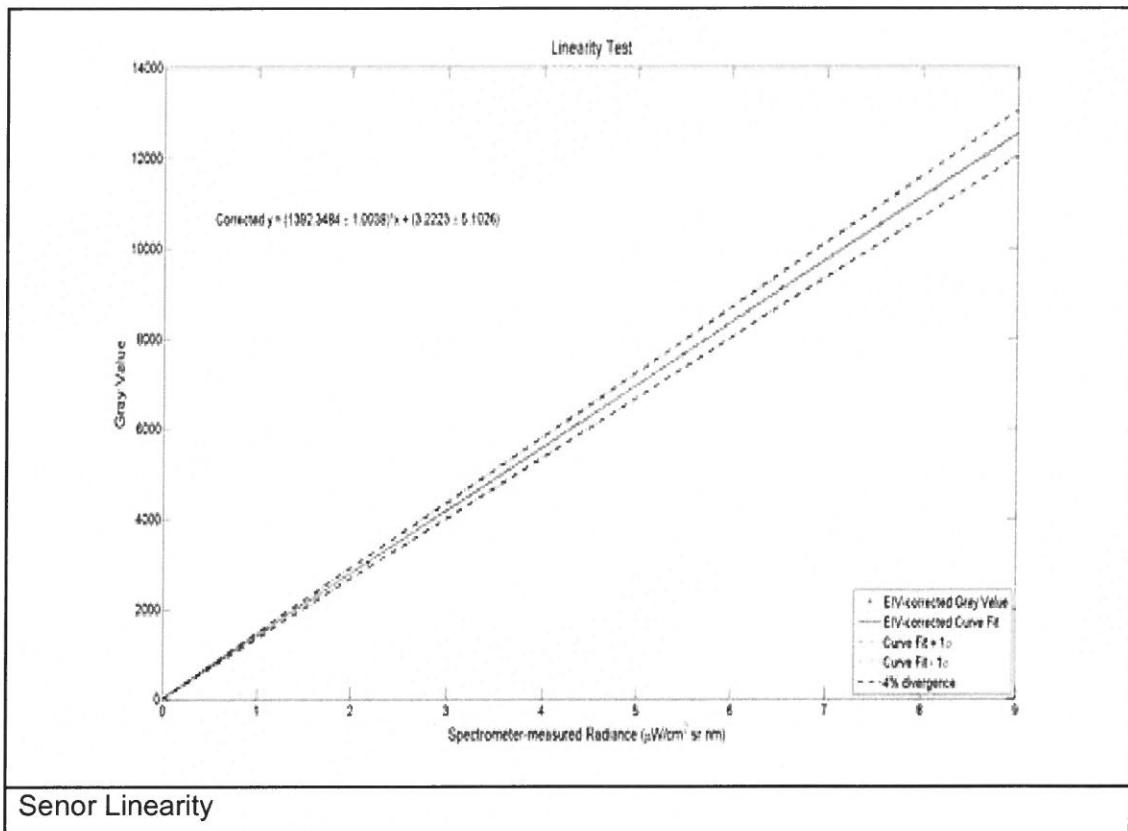
This is a camera type specific measurement.

## Radiometric Calibration

### Sensor Linearity (Reference)

The sensor linearity is measured in the Lab with calibrated spectrometer. This is a camera type specific calibration.

Below figure shows the linearity of the raw sensor and after flat fielding:



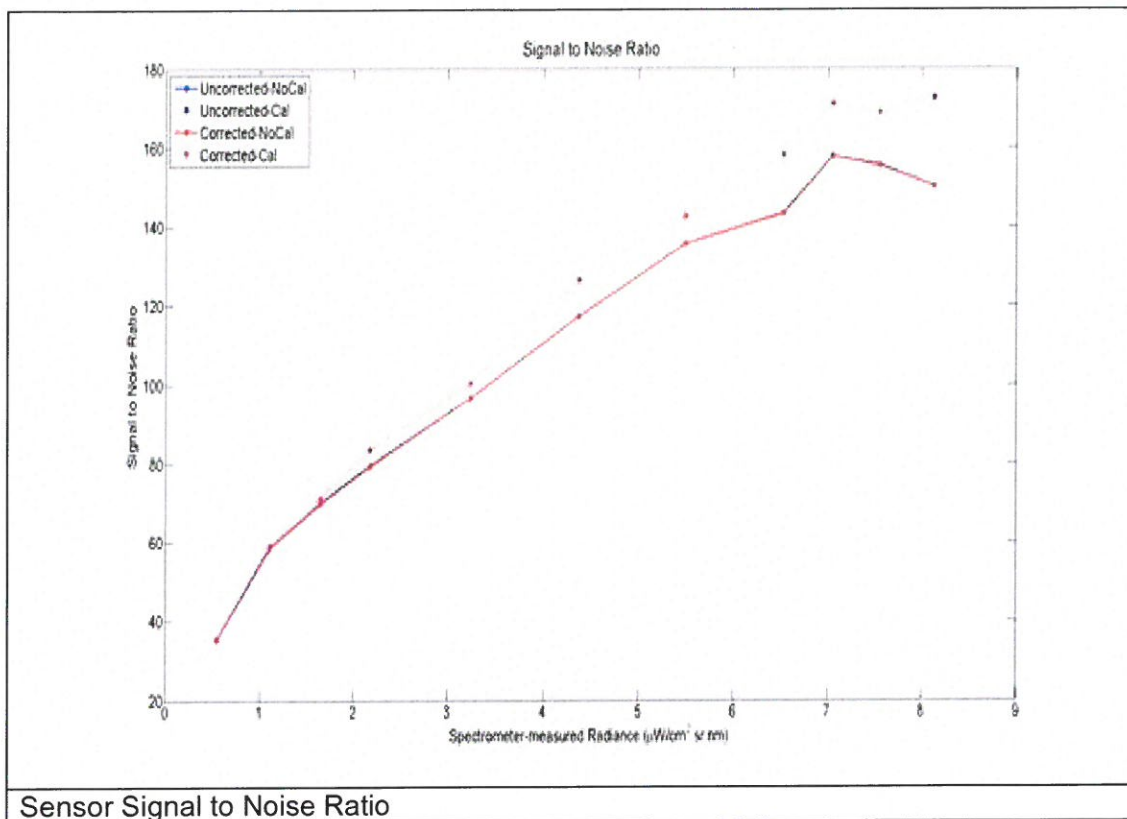
The deviation from the linearity is below 1%.

This is a camera type specific measurement.

## Radiometric Calibration

### Sensor Noise (Reference)

Sensor noise shows image noise with respect to the image center measured at an aperture of 16 with exposure time of 16msec.



Sensor Signal to Noise Ratio

This is from a camera type specific calibration.

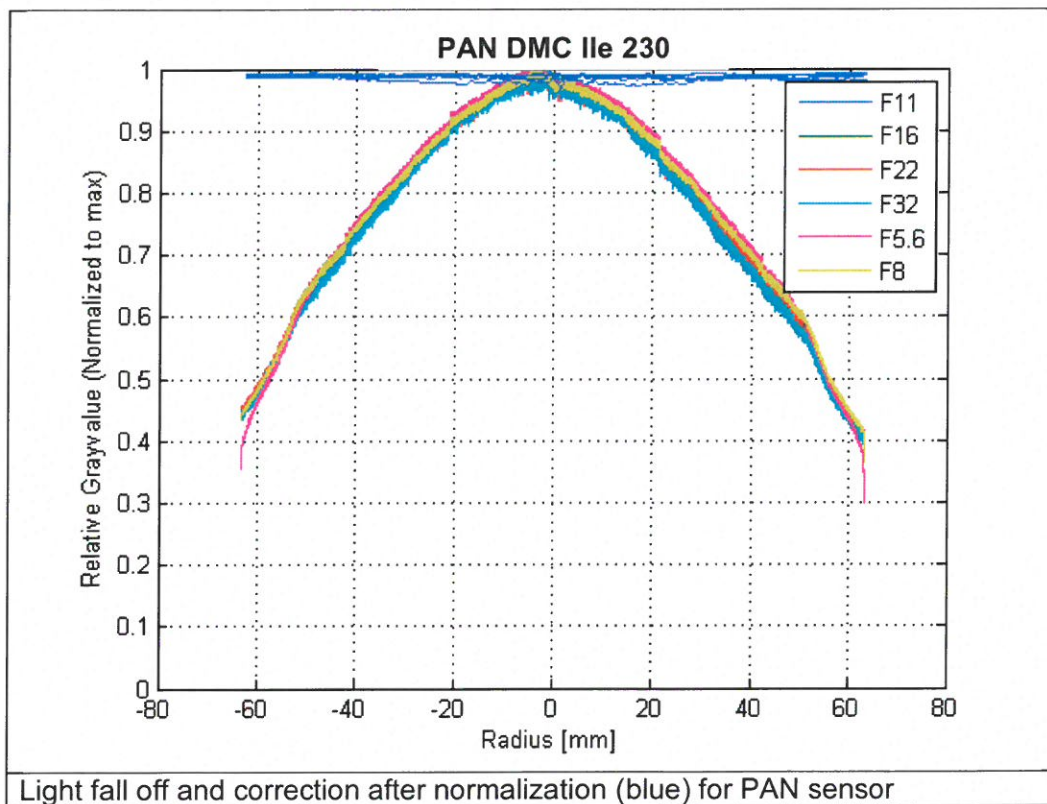


## Radiometric Calibration

### Aperture Correction (Reference)

#### Camera PAN (00123118)

The light fall off to the border due the influence of the optics depends on the aperture used. Therefore this calibration approach delivers individual calibration images for each aperture (Full F-Stop). In general the light fall off is a function of the image height (radial distance from center). The figure below shows the profile from the upper left corner to the lower right corner of the calibration images. Compensation of the light fall off can be measured after normalization and is within  $\pm 2.5\%$  of the dynamic range.



This is from a camera type specific calibration.

# Radiometric Calibration

## Defect Pixel

### Camera PAN (00123118)

Defect pixels are detected during radiometric calibration and will be corrected during radiometric processing of the images. The quantity and cumulative percentage and specification of defects is described in Appendix "Defect Pixel Recognition".

Revision of calibration:	131073	
CCDRevision:	1	
Date Number:	1407315066	
Date:	140806	
Number of defect pixels:	118	
Number of defect clusters:	0	
Number of defect columns:	0	
<b>Nr</b>	<b>Row</b>	<b>Column</b>
0	2159	93
1	2158	94
2	2159	94
3	2157	95
4	2158	95
5	2156	96
6	2157	96
7	2157	97
8	12217	131
9	12218	131
10	12219	131
11	12220	131
12	12217	132
13	12221	132
14	12217	133
15	12219	133
16	12221	133
17	12218	134
18	12219	134
19	12220	134
20	4621	193
21	12908	250
22	5697	293
23	11154	751
24	11155	751
25	11154	752
26	11155	752
27	11156	752
28	11157	752
29	11154	753
30	11155	753
31	11156	753
32	11157	753
33	11154	754
34	11155	754
35	11156	754
36	11157	754
37	11154	755
38	11155	755
39	11156	755
40	11154	756
41	11155	756
42	11154	757
43	11155	757
44	11156	758

## DMC IIe 230 Calibration

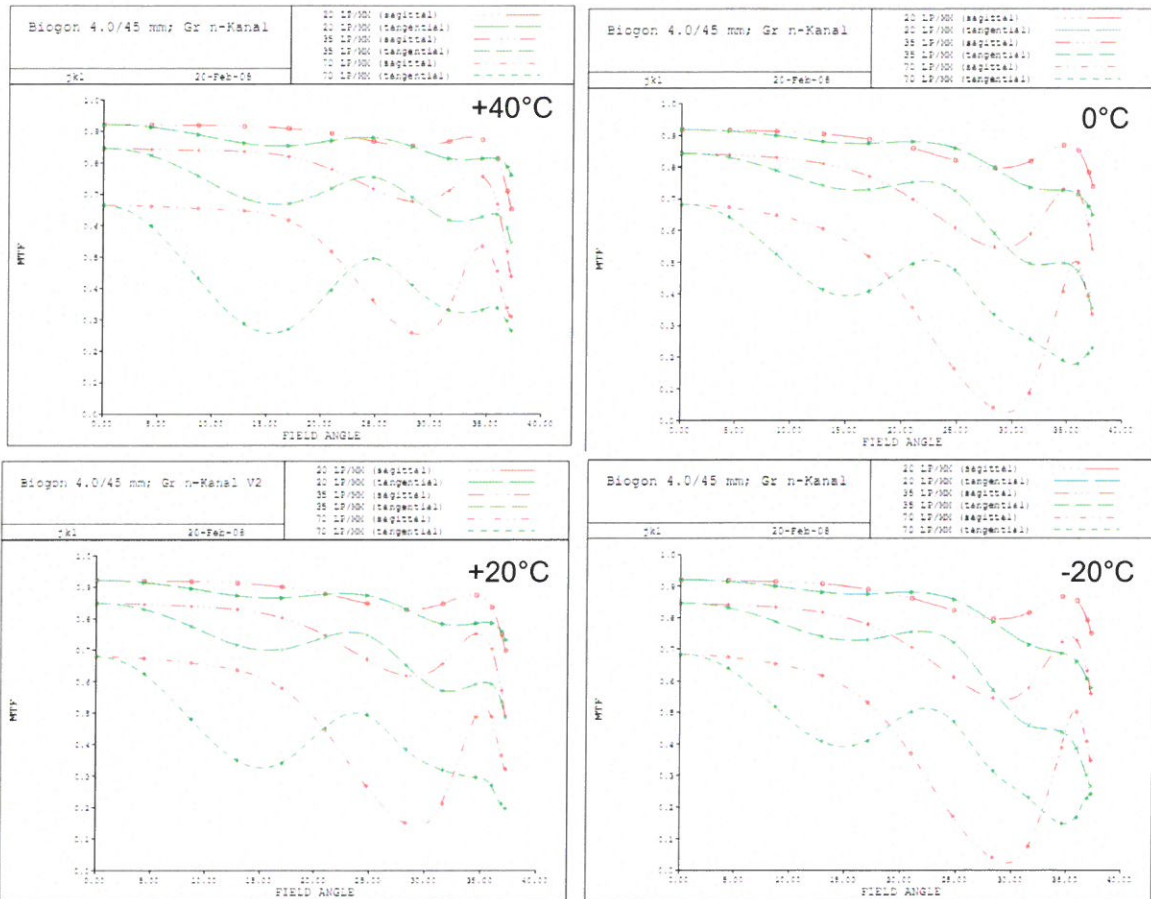
## Protocol

45	9279	1269
46	5123	2255
47	5124	2255
48	5122	2256
49	5123	2256
50	5124	2256
51	5122	2257
52	5123	2257
53	5122	2258
54	4836	2639
55	7969	2678
56	68	3448
57	10630	3934
58	13817	4119
59	10453	5815
60	10455	5816
61	10452	5817
62	10455	5818
63	8091	7649
64	1181	8221
65	13832	8952
66	13832	8953
67	1927	9003
68	4099	9385
69	1795	9839
70	13968	10057
71	7581	10337
72	3857	11219
73	3857	11220
74	9	12030
75	10078	12177
76	284	12529
77	285	12529
78	284	12530
79	285	12530
80	12861	12642
81	720	12813
82	721	12813
83	718	12814
84	1764	13207
85	1766	13207
86	1763	13208
87	1764	13208
88	1765	13208
89	1766	13208
90	1763	13209
91	1764	13209
92	1765	13209
93	3946	13948
94	1468	14431
95	6574	15166
96	2366	15352
97	2366	15353
98	5173	15447
99	3110	15461
100	11876	15652
101	11876	15653
102	11876	15654
103	11875	15655
104	11875	15656
105	5	16119
106	25	16207
107	25	16208
108	594	16442
109	12112	16711
110	13160	16972
111	13604	16981
112	13605	16981
113	13605	16982
114	5025	17151
115	5025	17152
116	10037	17182
117	10036	17183
Defect Column RowStart ColumnStart RowEnd ColumnEnd		

# Optical System

## Modulation Transfer Function, MTF of Green camera

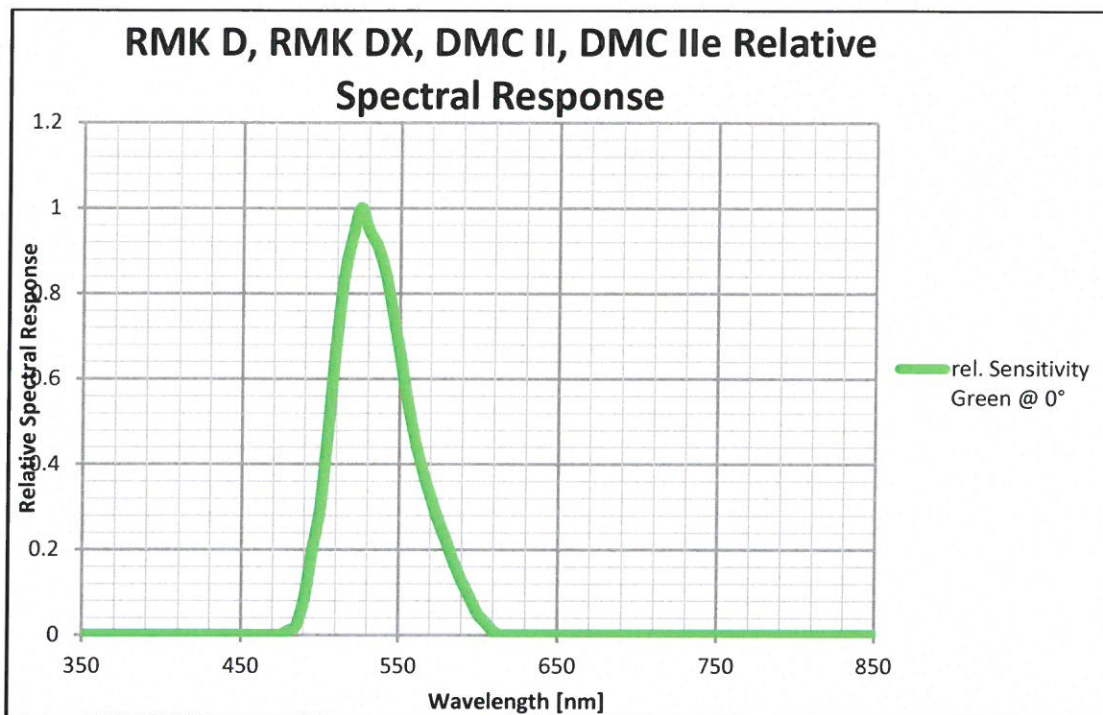
RMK D / RMK DX / DMC II / DMC IIe MS Green – MTF F/4.0 ; 45 mm– Temperature Stability



## Radiometric Calibration

### Sensitivity of Green camera

Spectral response curve of the single camera head.



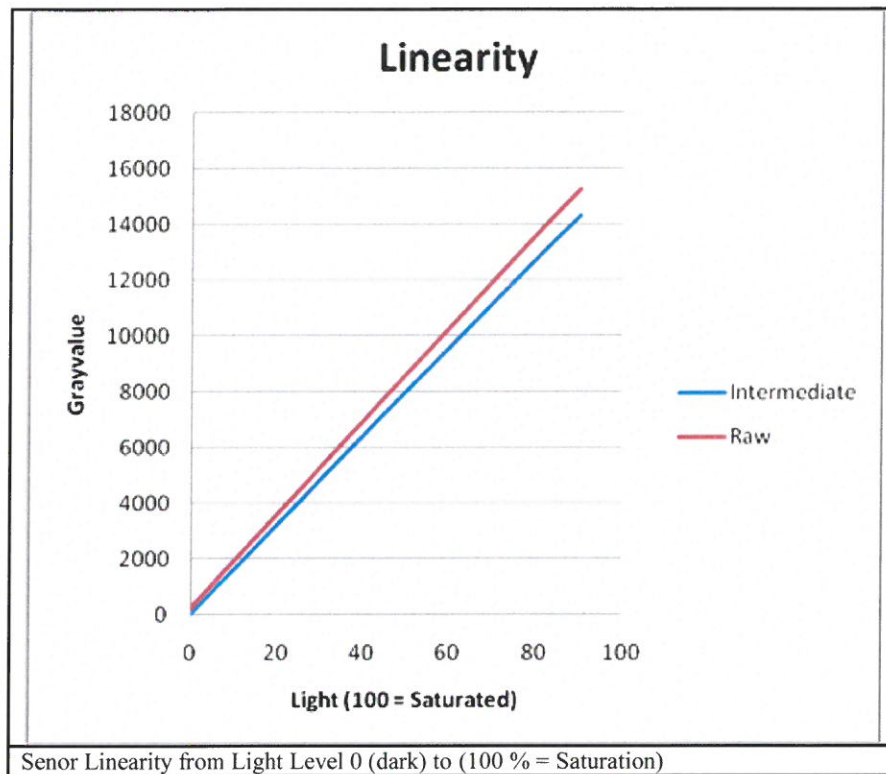
The sensitivity shows the spectral response curve of the single camera head including the optical system (optics, filter) and the sensor response. The DMC IIe 230 is calibrated with respect to the absolute spectrometer. This allows computing pixel radiance values from pixels digital numbers and is a camera type specific calibration.

## Radiometric Calibration

### Sensor Linearity (Reference)

The sensor linearity is measured in the Lab with calibrated spectrometer. This is a camera type specific calibration.

Below figure shows the linearity of the raw sensor and after flat fielding:

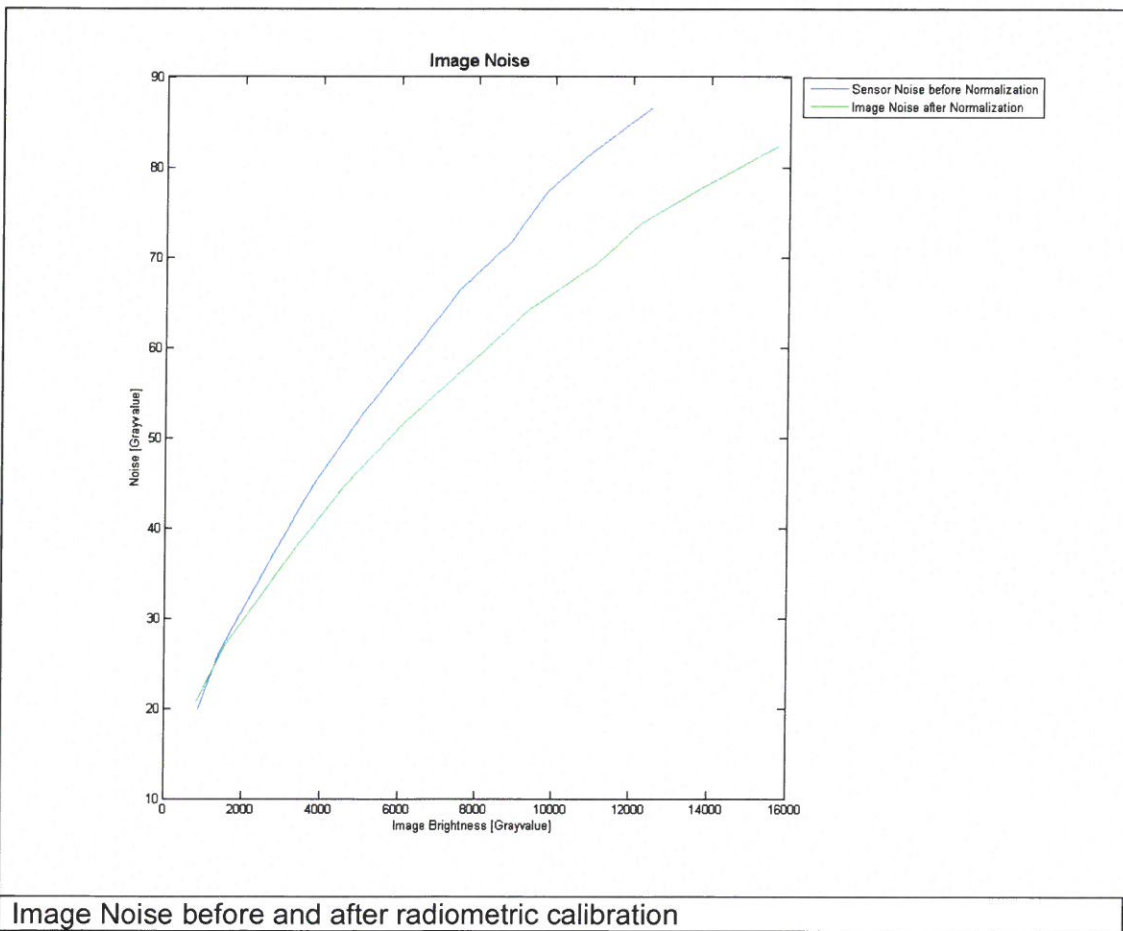


The deviation from the linearity is below 1%.

# Radiometric Calibration

## Sensor Noise (Reference)

Sensor noise shows image noise with respect to the image center measured at an aperture of 8 with exposure time of 22msec. Sensor noise after calibration shall be less or equal 0.5% of radiometric resolution. At 14bit radiometric resolution 0.5% (of 16384) is equal to 82 gray values. This is a camera type specific calibration.

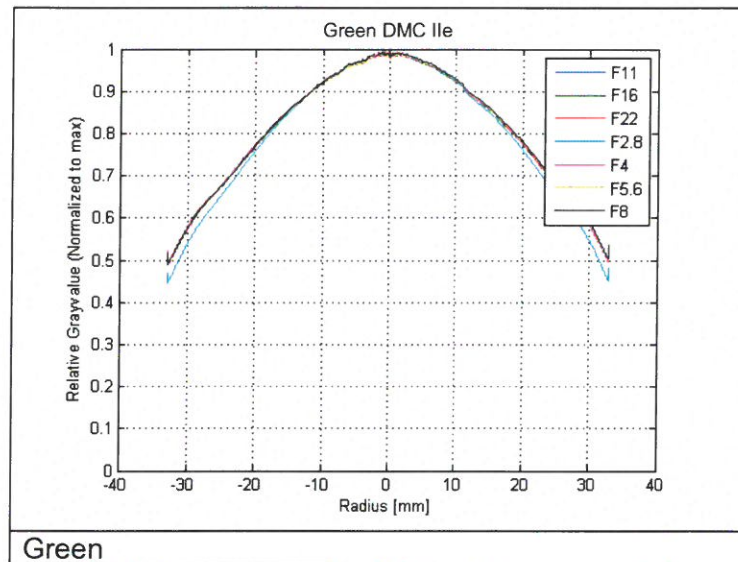


# Radiometric Calibration

## Aperture Correction

### Green (00124739)

The light fall off to the border due the influence of the optics depends on the aperture used. Therefore this calibration approach delivers individual calibration images for each aperture (Full F-Stop). In general the light fall off is a function of the image height (radial distance from center). The figure below shows the profile from the upper left corner to the lower right corner of the calibration images.



This is a camera type specific calibration.



# Radiometric Calibration

## Defect Pixel

### Green (00124739)

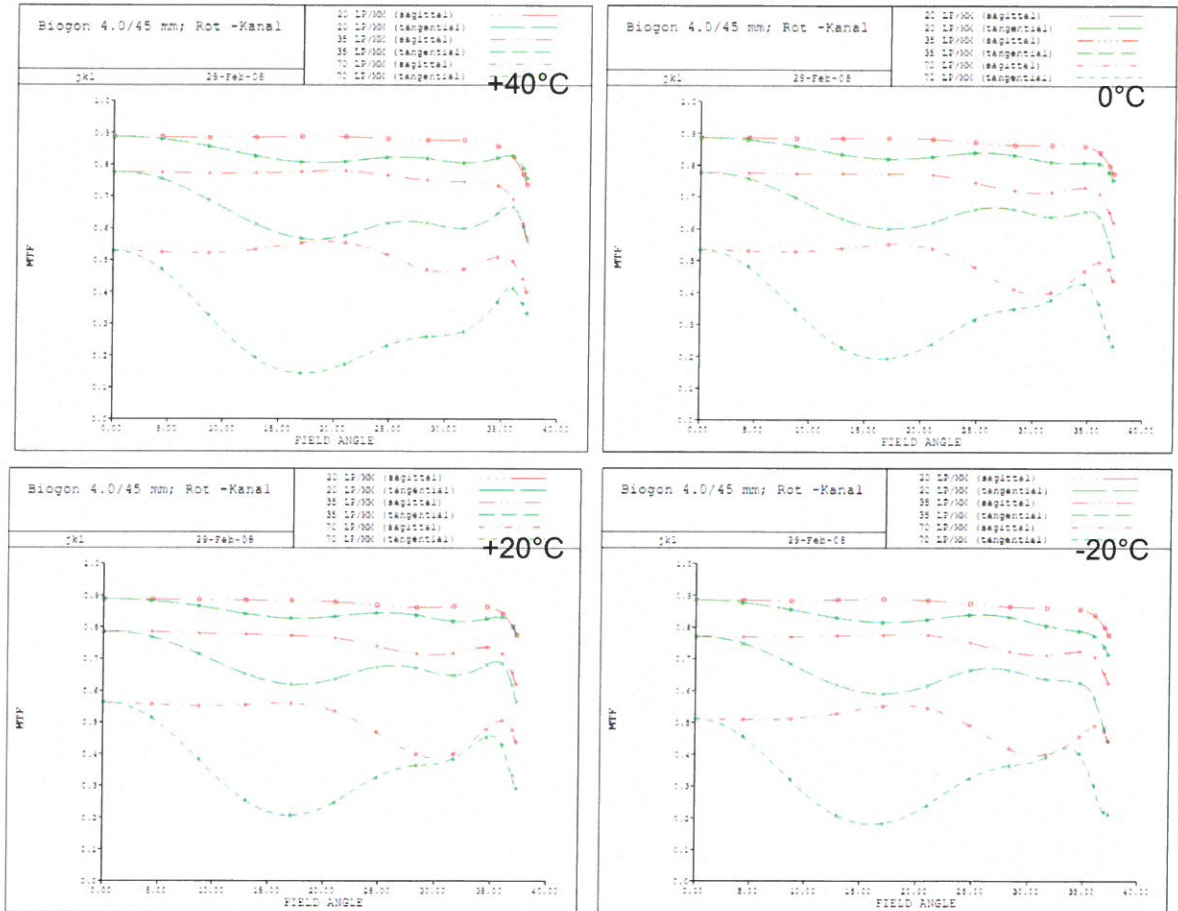
Defect pixels are detected during radiometric calibration and will be corrected during radiometric processing of the images. The quantity and cumulative percentage and specification of defects is described in Appendix "Defect Pixel Recognition".

Revision of calibration:	131073			
CCDRevision:	1			
Date Number:	1412091251			
Date:	140930			
Number of defect pixels:	2			
Number of defect clusters:	0			
Number of defect columns:	0			
Nr	Row	Column		
0	2233	1176		
1	4612	4473		
Defect Column	RowStart	ColumnStart	RowEnd	ColumnEnd

# Optical System

## Modulation Transfer Function, MTF of Red camera

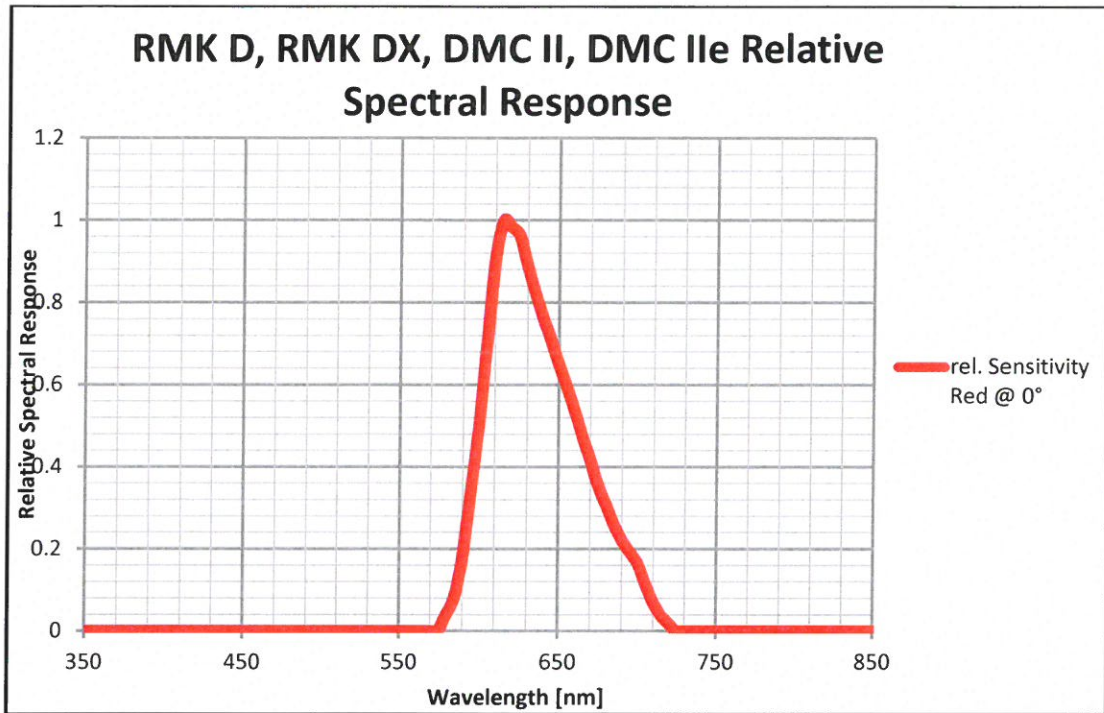
RMK D / RMK DX / DMC II / DMC IIe MS Red – MTF F/4.0 ; 45 mm– Temperature Stability



## Radiometric Calibration

### Sensitivity of Red camera

Spectral Response Curves of the single camera head.



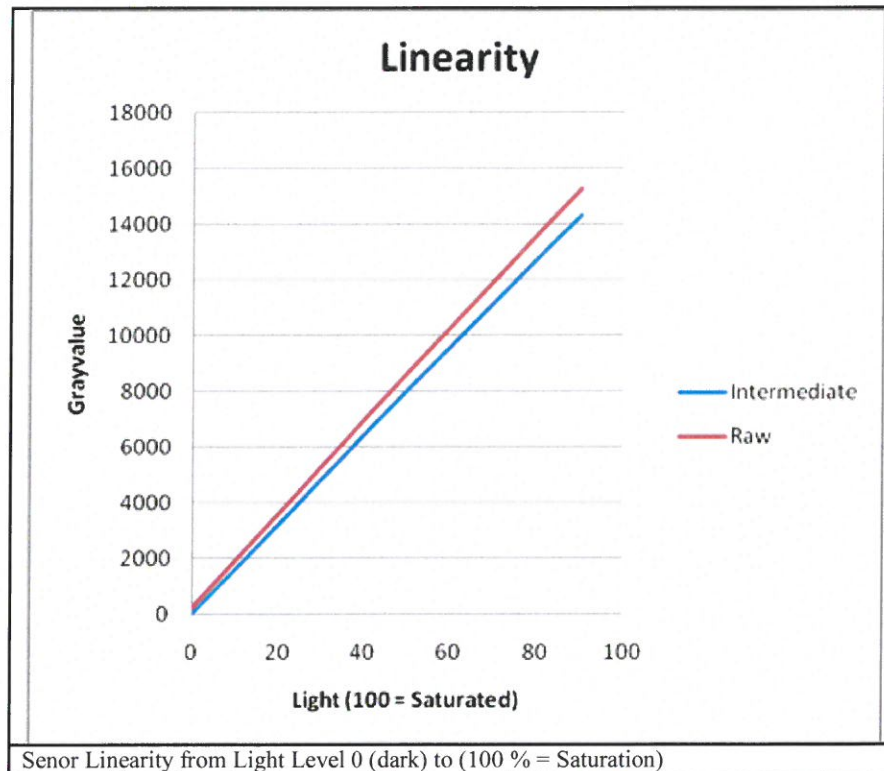
The sensitivity shows the spectral response curve of the single camera head including the optical system (optics, filter) and the sensor response. The DMC IIe 230 is calibrated with respect to the absolute spectrometer. This allows computing pixel radiance values from pixels digital numbers and is a camera type specific calibration.

## Radiometric Calibration

### Sensor Linearity (Reference)

The sensor linearity is measured in the Lab with calibrated spectrometer. This is a camera type specific calibration.

Below figure shows the linearity of the raw sensor and after flat fielding:

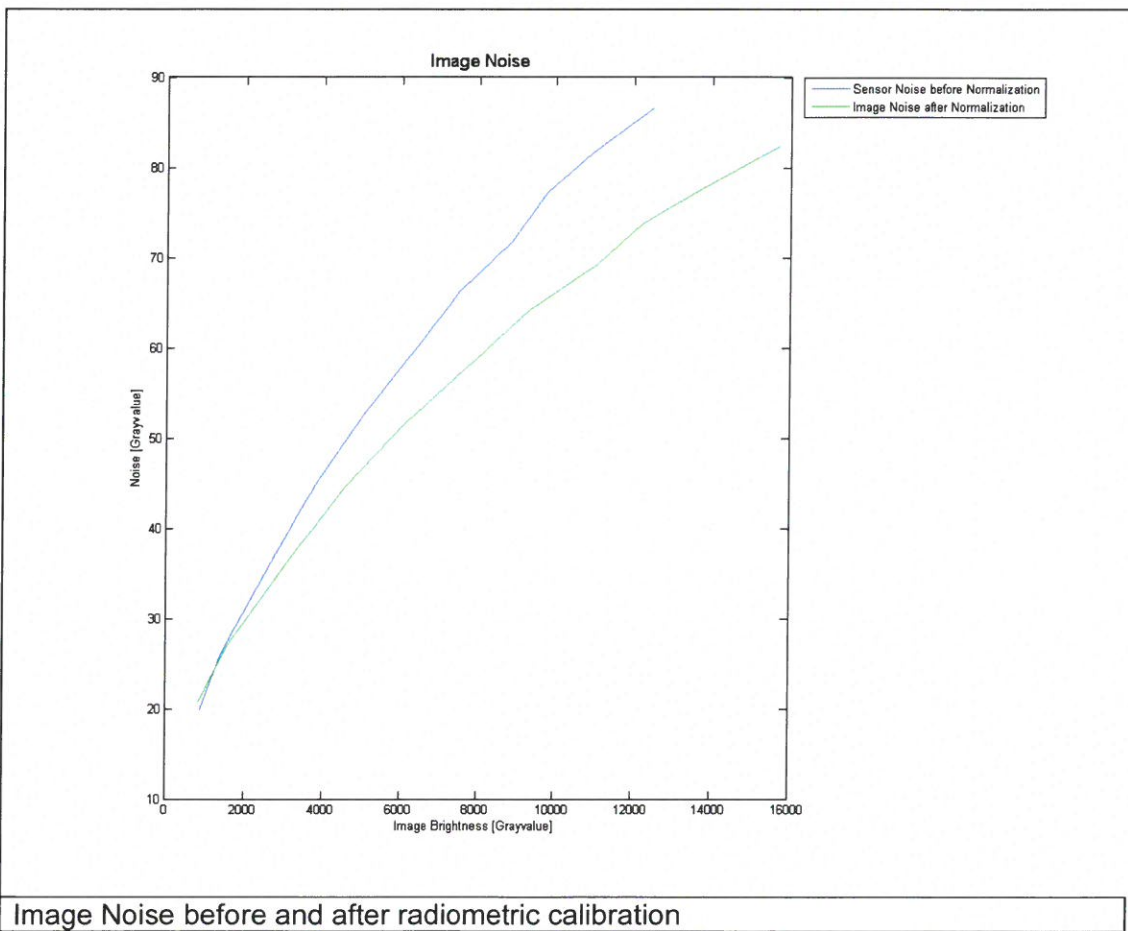


The deviation from the linearity is below 1%.

# Radiometric Calibration

## Sensor Noise (Reference)

Sensor noise shows image noise with respect to the image center measured at an aperture of 8 with exposure time of 22msec. Sensor noise after calibration shall be less or equal 0.5% of radiometric resolution. At 14bit radiometric resolution 0.5% (of 16384) is equal to 82 gray values. This is a camera type specific calibration.

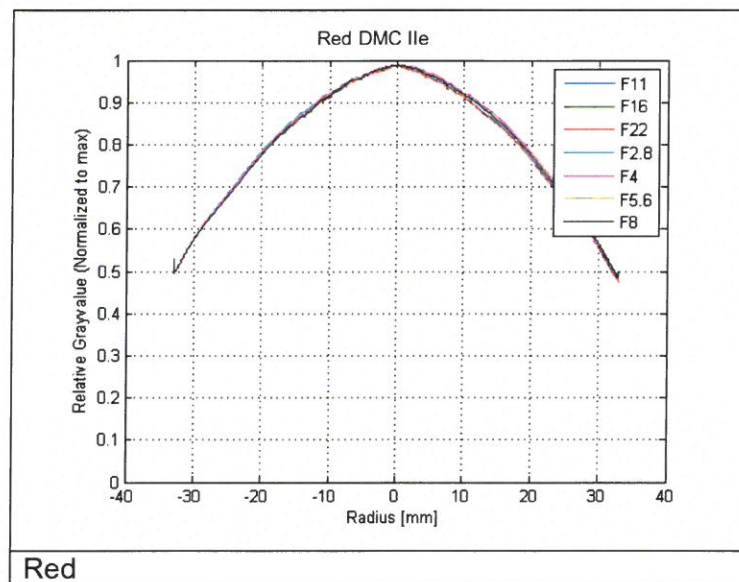


# Radiometric Calibration

## Aperture Correction

### Red (00124693)

The light fall off to the border due the influence of the optics depends on the used aperture. Therefore this calibration approach has for each aperture (Full F-Stop) its own calibration image. In general the light fall off is a function of the image radius. In this calibration approach instead of function the real measured values in the image is used. The figure below shows the profile from the upper left corner to the lower right corner of each of this calibration images to give a feeling on the amount of correction.



This is a camera type specific calibration.

# Radiometric Calibration

## Defect Pixel

### Red (00124693)

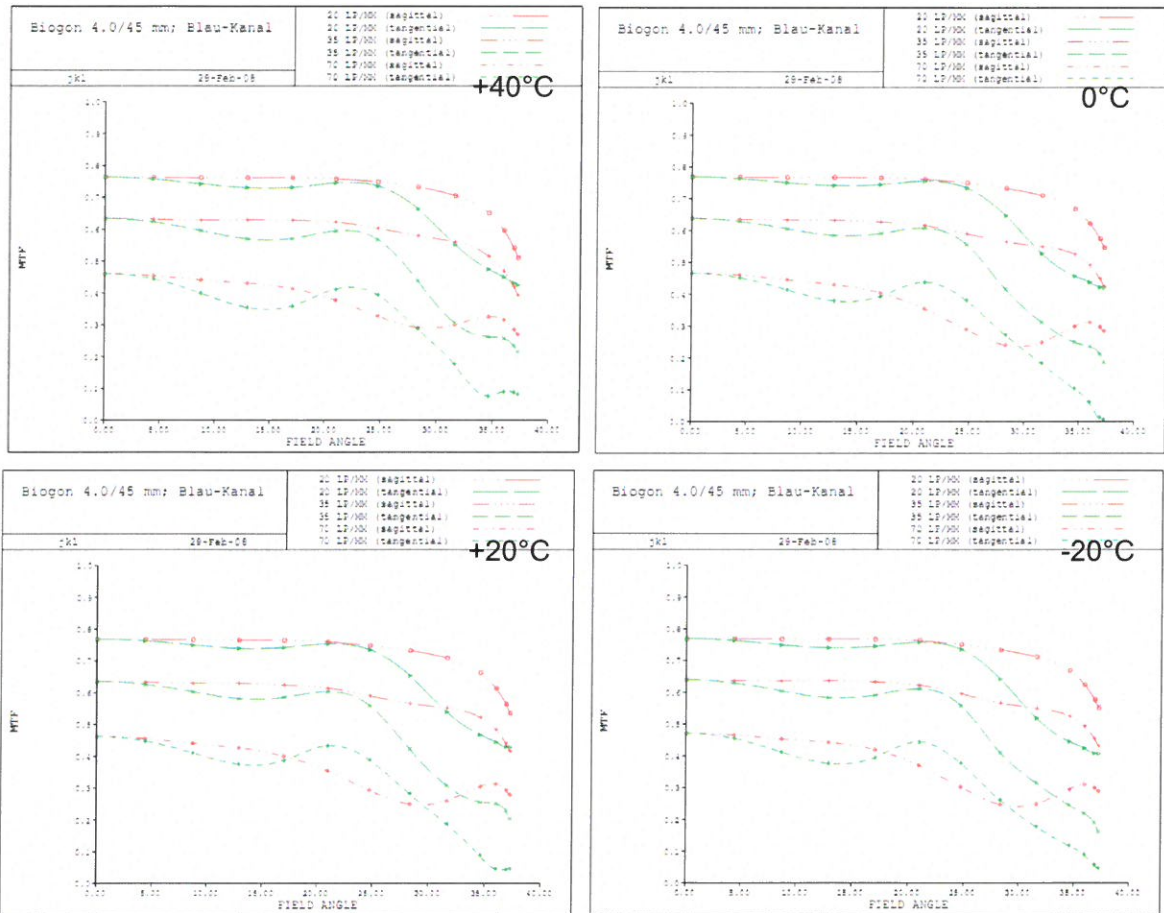
Defect pixels are detected during radiometric calibration and will be corrected during radiometric processing of the images. The quantity and cumulative percentage and specification of defects is described in Appendix "Defect Pixel Recognition".

Revision of calibration:	131073			
CCDRevision:	1			
Date Number:	1412093373			
Date:	140930			
Number of defect pixels:	4			
Number of defect clusters:	0			
Number of defect columns:	0			
Nr	Row	Column		
0	1906	69 1905		
1	1908	68 1906		
2	2011	716 2008		
3	3302	1189 3298		
Defect Column	RowStart	ColumnStart	RowEnd	ColumnEnd

# Optical System

## Modulation Transfer Function, MTF of Blue camera

RMK D / RMK DX / DMC II / DMC IIe MS Blue – MTF F/4.0 ; 45 mm– Temperature Stability

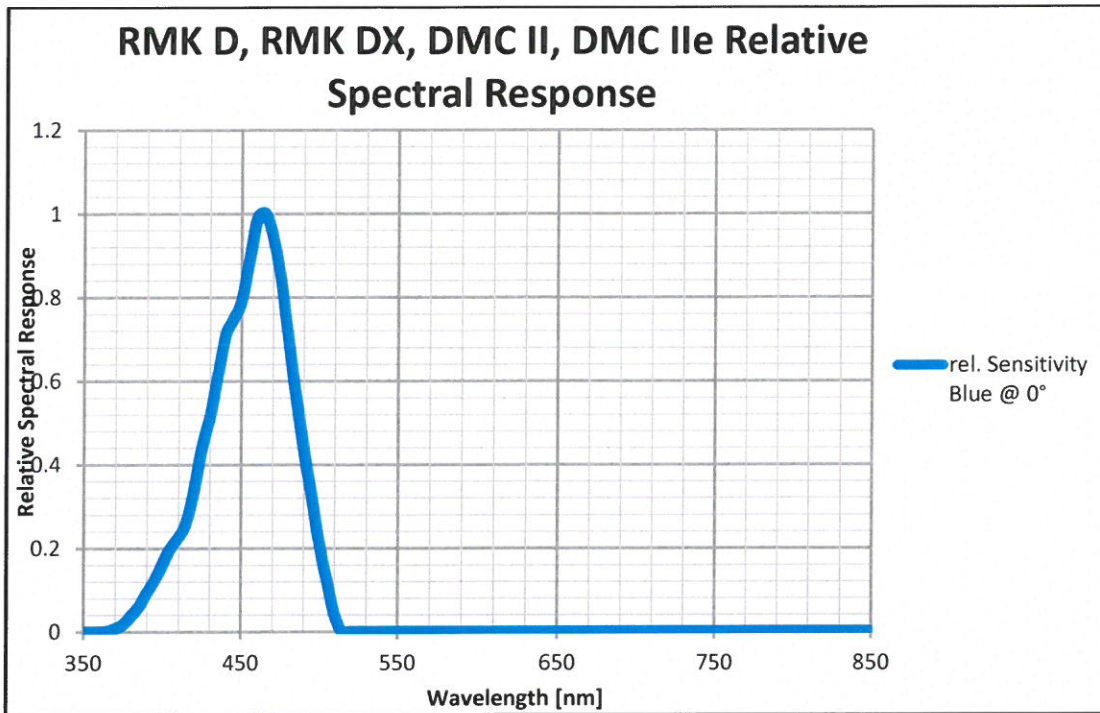




## Radiometric Calibration

### Sensitivity of Blue camera

Spectral Response Curves of the single camera head.



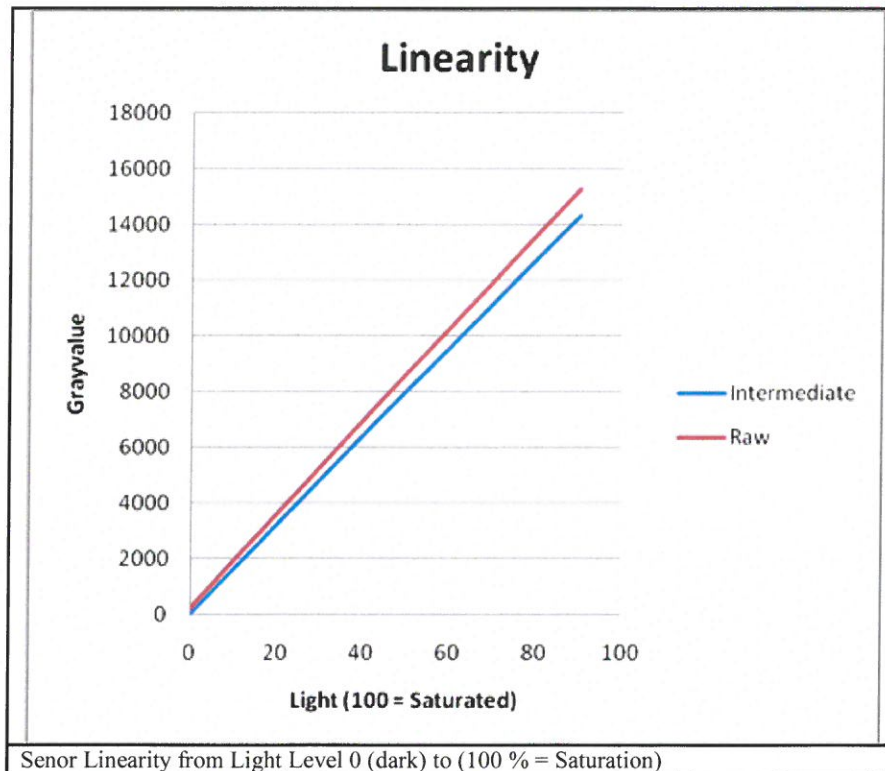
The sensitivity shows the spectral response curve of the single camera head including the optical system (optics, filter) and the sensor response. The DMC IIe 230 is calibrated with respect to the absolute spectrometer. This allows computing pixel radiance values from pixels digital numbers and is a camera type specific calibration.

## Radiometric Calibration

### Sensor Linearity (Reference)

The sensor linearity is measured in the Lab with calibrated spectrometer. This is a camera type specific calibration.

Below figure shows the linearity of the raw sensor and after flat fielding:

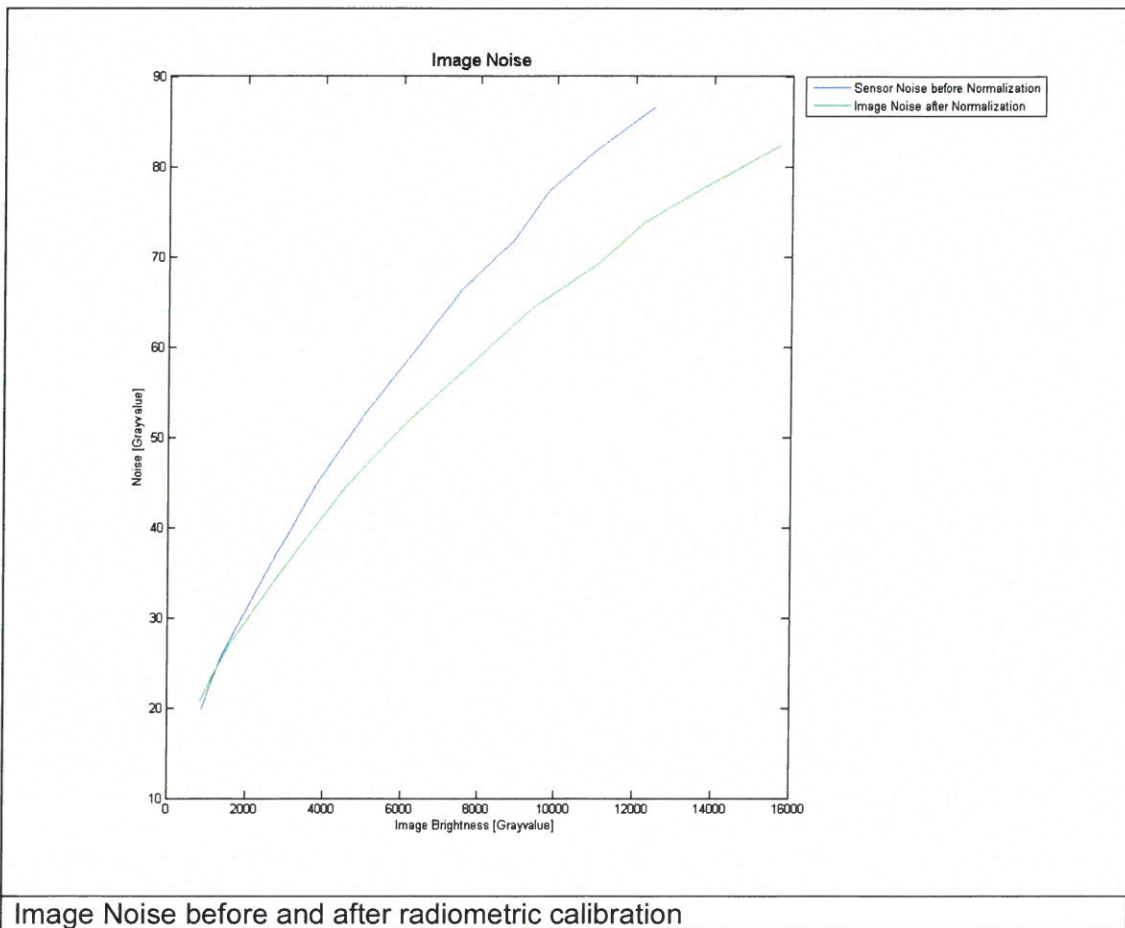


The deviation from the linearity is below 1%.

## Radiometric Calibration

### Sensor Noise (Reference)

Sensor noise shows image noise with respect to the image center measured at an aperture of 8 with exposure time of 22msec. Sensor noise after calibration shall be less or equal 0.5% of radiometric resolution. At 14bit radiometric resolution 0.5% (of 16384) is equal to 82 gray values. This is a camera type specific calibration.

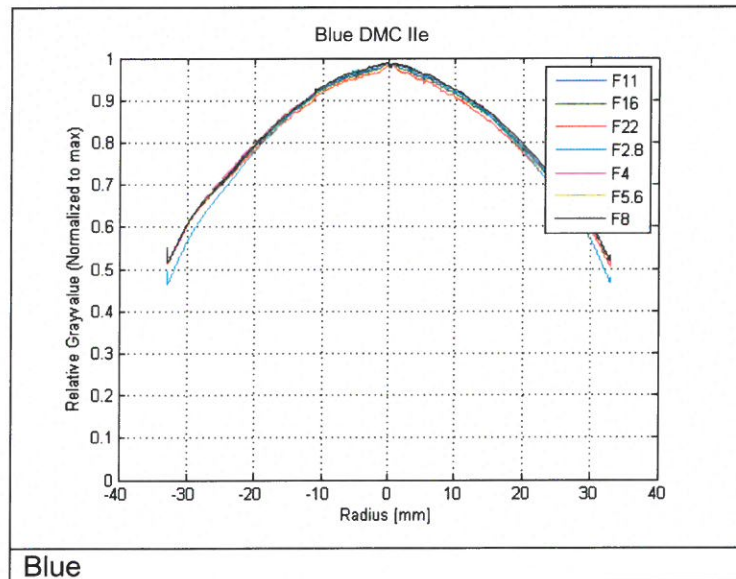


## Radiometric Calibration

### Aperture Correction

#### Blue (00124736)

The light fall off to the border due the influence of the optics depends on the used aperture. Therefore this calibration approach has for each aperture (Full F-Stop) its own calibration image. In general the light fall off is a function of the image radius. In this calibration approach instead of function the real measured values in the image is used. The figure below shows the profile from the upper left corner to the lower right corner of each of this calibration images to give a feeling on the amount of correction.



This is a camera type specific calibration.

# Radiometric Calibration

## Defect Pixel

### Blue (00124736)

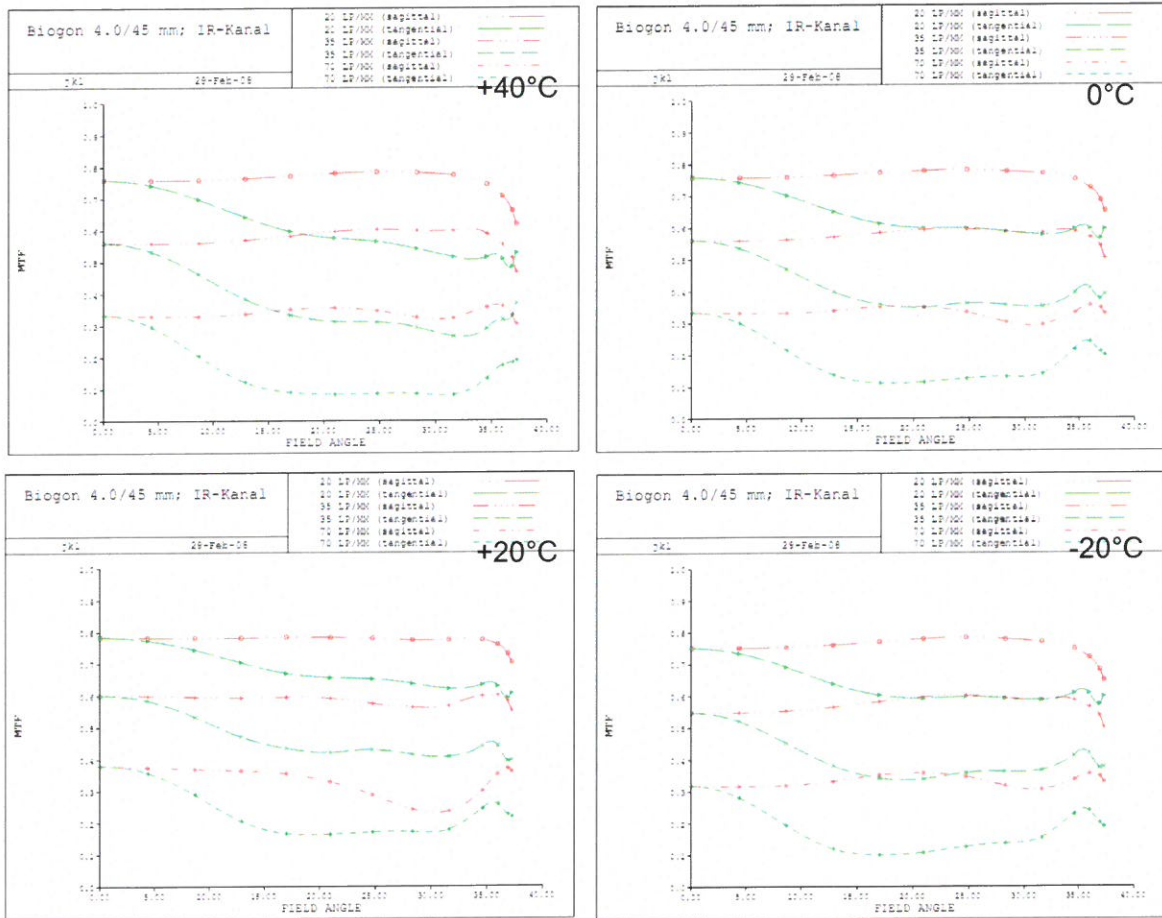
Defect pixels are detected during radiometric calibration and will be corrected during radiometric processing of the images. The quantity and cumulative percentage and specification of defects is described in Appendix "Defect Pixel Recognition".

Revision of calibration:	131073			
CCDRevision:	1			
Date Number:	1412092319			
Date:	140930			
Number of defect pixels:	6			
Number of defect clusters:	0			
Number of defect columns:	0			
Nr	Row	Column		
0	5491	104		
1	5492	104		
2	3577	541		
3	3578	541		
4	6134	6030		
5	6135	6030		
Defect Column	RowStart	ColumnStart	RowEnd	ColumnEnd

# Optical System

## Modulation Transfer Function, MTF of IR camera

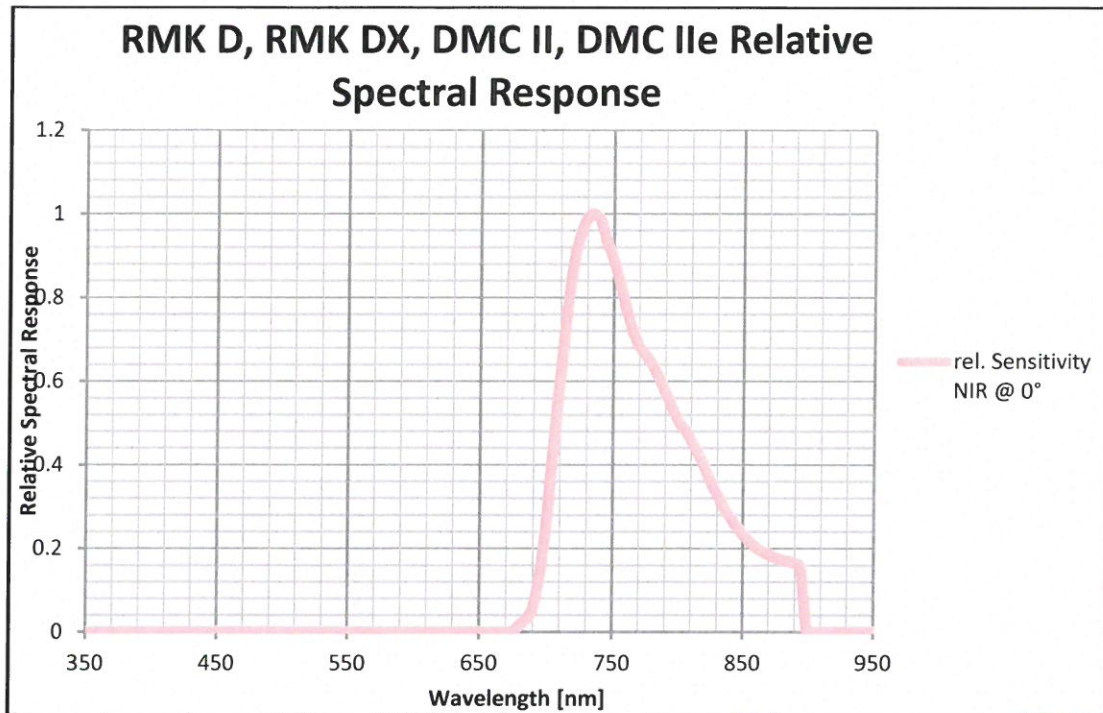
RMK D / RMK DX / DMC II / DMC IIe MS IR – MTF F/4.0 ; 45 mm– Temperature Stability



## Radiometric Calibration

### Sensitivity of NIR camera

Spectral Response Curves of the single camera head.



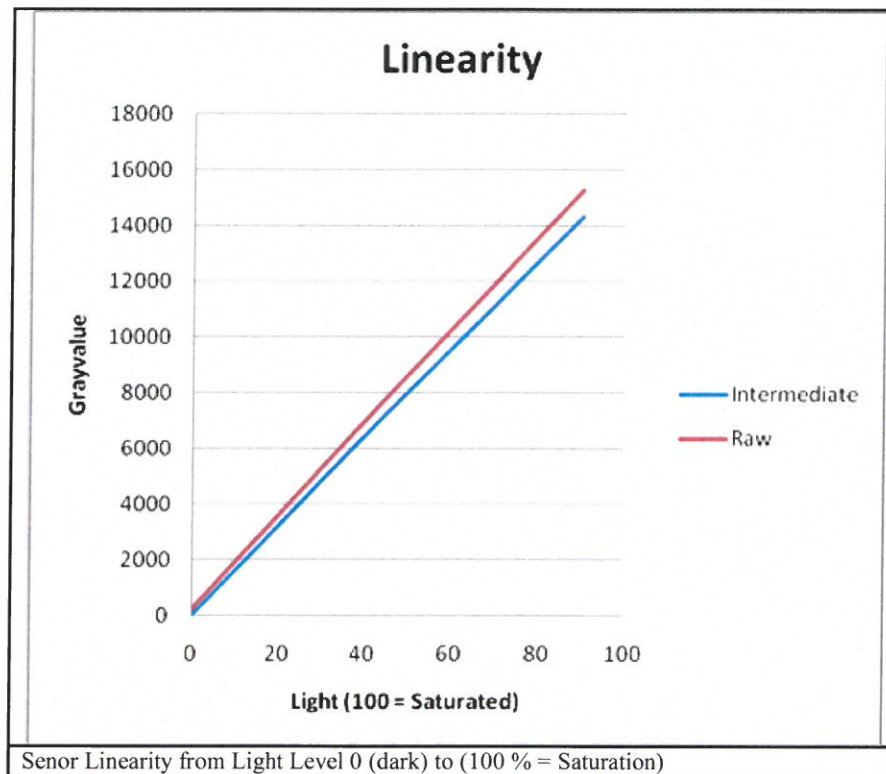
The sensitivity shows the spectral response curve of the single camera head including the optical system (optics, filter) and the sensor response. The DMC IIe 230 is calibrated with respect to the absolute spectrometer. This allows computing pixel radiance values from pixels digital numbers and is a camera type specific calibration.

## Radiometric Calibration

### Sensor Linearity (Reference)

The sensor linearity is measured in the Lab with calibrated spectrometer. This is a camera type specific calibration.

Below figure shows the linearity of the raw sensor and after flat fielding:



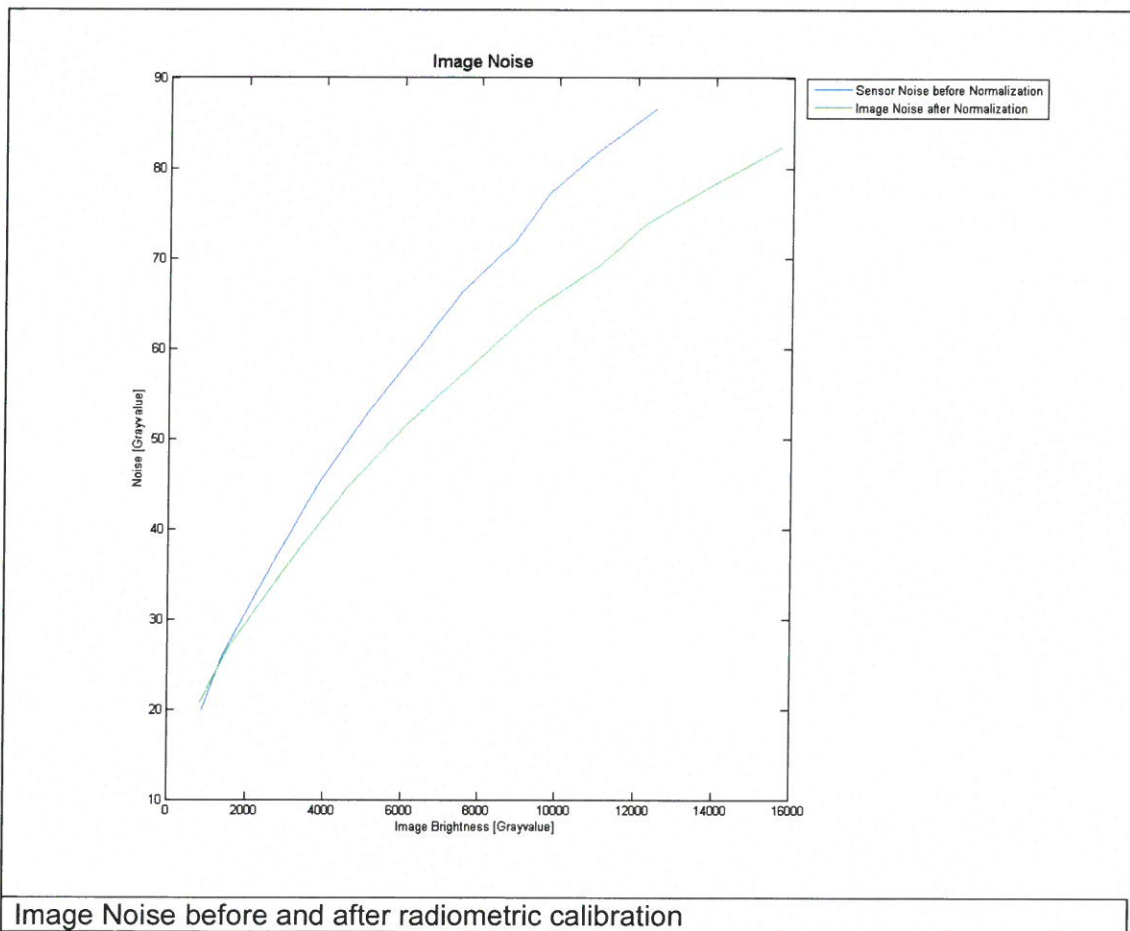
The deviation from the linearity is below 1%.



# Radiometric Calibration

## Sensor Noise (Reference)

Sensor noise shows image noise with respect to the image center measured at an aperture of 8 with exposure time of 22msec. Sensor noise after calibration shall be less or equal 0.5% of radiometric resolution. At 14bit radiometric resolution 0.5% (of 16384) is equal to 82 gray values. This is a camera type specific calibration.

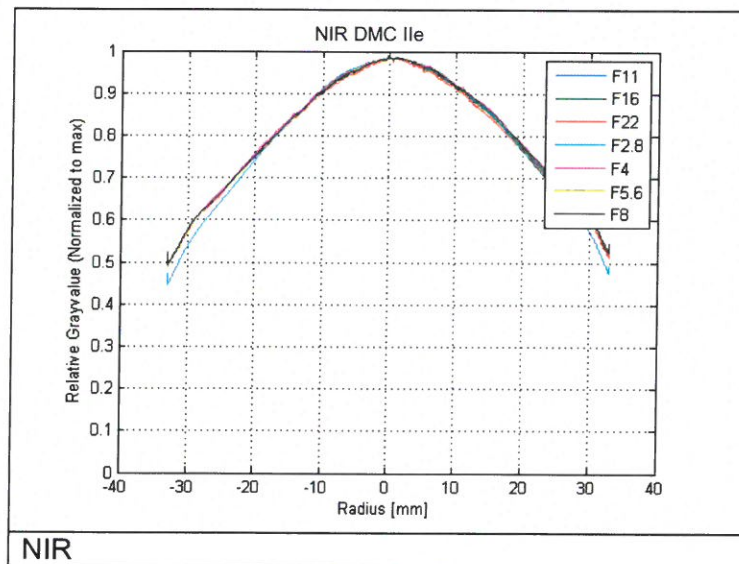


## Radiometric Calibration

### Aperture Correction

#### NIR (00118804)

The light fall off to the border due the influence of the optics depends on the used aperture. Therefore this calibration approach has for each aperture (Full F-Stop) its own calibration image. In general the light fall off is a function of the image radius. In this calibration approach instead of function the real measured values in the image is used. The figure below shows the profile from the upper left corner to the lower right corner of each of this calibration images to give a feeling on the amount of correction.



This is a camera type specific calibration.

# Radiometric Calibration

## Defect Pixel

### NIR (00118804)

Defect pixels are detected during radiometric calibration and will be corrected during radiometric processing of the images. The quantity and cumulative percentage and specification of defects is described in Appendix "Defect Pixel Recognition".

Revision of calibration:	131073	
CCDRevision:	1	
Date Number:	1418230290	
Date:	141210	
Number of defect pixels:	236	
Number of defect clusters:	0	
Number of defect columns:	0	
<b>Nr</b>	<b>Row</b>	<b>Column</b>
0	2516	4988
1	30	773
2	81	5346
3	99	2568
4	100	4557
5	160	3924
6	161	3154
7	319	3355
8	377	617
9	409	5164
10	411	5155
11	634	4946
12	658	302
13	695	5362
14	775	5479
15	918	4606
16	1024	1833
17	1184	1331
18	1189	5350
19	1213	1381
20	1226	3741
21	1231	830
22	1282	5470
23	1282	4383
24	1298	1852
25	1350	2496
26	1455	4483
27	1458	1475
28	1458	2528
29	1519	1174
30	1589	5290
31	1613	2570
32	1614	2566
33	1636	5967
34	1706	5005
35	1736	4601
36	1767	4569
37	1776	5934
38	1784	3836
39	1852	6059
40	1855	4146
41	1892	1566
42	1902	3591
43	1957	2926

44	2012	1083
45	2015	6080
46	2043	4346
47	2123	750
48	2124	791
49	2151	3473
50	2162	4454
51	2205	1068
52	2295	476
53	2327	5169
54	2354	4722
55	2524	2030
56	2567	2606
57	2804	4915
58	2806	4258
59	2817	2693
60	2829	5095
61	2830	5019
62	2859	1877
63	2878	3616
64	2885	971
65	2888	4685
66	2927	3534
67	3018	5347
68	3037	2915
69	3096	3155
70	3199	5615
71	3250	5987
72	3251	5987
73	3270	317
74	3320	4513
75	3350	1101
76	3376	4158
77	3381	3580
78	3416	1723
79	3490	725
80	3553	6054
81	3565	2889
82	3591	5317
83	3639	5841
84	3645	4247
85	3646	4513
86	3646	4549
87	3757	6090
88	3783	532
89	3870	3159
90	3889	3980
91	3896	5055
92	3954	4639
93	4022	3409
94	4028	4660
95	4123	5622
96	4164	5004
97	4165	3110
98	4167	1878
99	4178	337
100	4275	4660
101	4301	5494
102	4363	3689
103	4387	4723
104	4404	4766
105	4438	6056
106	4442	2374
107	4476	5080
108	4489	3059
109	4627	4233
110	4645	4259
111	4655	2144
112	4670	5171
113	4701	335
114	4704	3645
115	4712	3499
116	4731	1731
117	4737	2332
118	4749	5879
119	4752	1342
120	4764	4945

121	4777	3462
122	4790	5196
123	4805	2251
124	4826	1827
125	4853	4011
126	4859	2488
127	5075	2739
128	5108	3954
129	5110	3865
130	5138	1019
131	5142	2654
132	5142	5974
133	5233	2227
134	5243	902
135	5284	2860
136	5289	869
137	5294	2742
138	5314	5077
139	5373	4781
140	5397	2013
141	5408	2335
142	5436	238
143	5442	1958
144	5443	1957
145	5481	793
146	5495	5489
147	5540	1759
148	5595	5447
149	5602	4827
150	5622	5112
151	5637	6013
152	5670	4639
153	5676	2638
154	5731	4110
155	5741	4712
156	5830	5779
157	5832	5196
158	5835	1188
159	5836	2627
160	5849	2492
161	5856	1032
162	5863	5554
163	5863	3874
164	5876	1355
165	5930	5414
166	5959	4501
167	5962	5895
168	5964	5230
169	5966	3821
170	5969	3867
171	5975	3793
172	5977	5705
173	5983	3889
174	5990	3832
175	6023	4699
176	6082	2916
177	6086	4173
178	6121	3006
179	6126	4280
180	6128	2954
181	6142	2260
182	6142	4551
183	6146	4412
184	6153	3309
185	6156	4577
186	6220	5917
187	6221	3046
188	6232	5835
189	6240	732
190	6245	3335
191	6255	5783
192	6263	4349
193	6275	179
194	6279	4157
195	6280	549
196	6285	3469
197	6332	3355

198	6332	3355			
199	6333	3134			
200	6340	3102			
201	6351	5669			
202	6351	5454			
203	6369	5918			
204	6389	5248			
205	6417	4218			
206	6422	5892			
207	6424	4681			
208	6434	683			
209	6436	2044			
210	6442	3310			
211	6451	5294			
212	6452	1295			
213	6464	2809			
214	6467	4938			
215	6484	3303			
216	6549	3861			
217	6554	5988			
218	6572	3970			
219	6600	3817			
220	6608	667			
221	6646	5523			
222	6657	3102			
223	6735	1753			
224	6761	5934			
225	6765	4628			
226	6770	4055			
227	6772	2680			
228	6786	5345			
229	6788	4513			
230	6799	5611			
231	6803	206			
232	6809	4615			
233	6819	1407			
234	6832	296			
235	6835	3973			
Defect Column RowStart ColumnStart RowEnd ColumnEnd					

## Sensor Geometric Accuracy

Large area CCD imagers are composed (stitched) from several blocks. Stitching on wafer with semiconductor lithographic equipment results in geometric accuracy better than  $0.1\mu\text{m}$  ( Stoldt, H. (2010) ).

Therefore the geometric accuracy of individual pixels within a block can be assumed as better or equal the stitching accuracy.

## Defect Pixel Recognition

The table below shows the maximal allowed physical defects on the CCD Sensor and its definitions.

	Description	CCD Spec
Pixel	Bright image	Pixel whose signal, at nominal light (illumination at 50% of the linear range), deviates more than $\pm 30\%$ from its neighboring pixels.
	Dark image	Pixel whose signal, in dark, deviates more than 6mV from its neighboring pixels (about 1% of nominal light).
	Max Count	PAN $\leq$ 3500 MS <500

	Description	CCD Spec
Column	Definition	A column which has more than 8 pixel defects in 1 x 12 kernel Column defects must be horizontally separated by 5 columns for single line defects and 10 for double line defects
	Recognition (bright and dark)	Same as defect pixel recognition
	Max Single column	PAN $\leq$ 140 MS $\leq$ 20
	Max double Column	PAN $\leq$ 40 MS $\leq$ 6

The Post-Processing-Software is correcting following pixel and columns:

PPS Correction	
Pixel	Pixel whose gray value in a 16 x16 kernel differs from the median more than 30%

PPS Correction	
Column	Pixel whose gray value in a 16 x16 kernel differs from the median more than 5% and more than 15 defects in one column



## Bibliography

Brown D. C. Close-Range Camera Calibration, *Photogrammetric Engineering* 37(8) 1971

Dörstel C., Jacobsen K., Stallmann D. (2003): DMC – Photogrammetric accuracy – Calibration aspects and Generation of synthetic DMC images, Eds. M. Baltsavias / A.Grün, *Optical 3D Sensor Workshop*, Zürich

Fraser C., Digital Camera self calibration. *ISPRS Journal of Photogrammetry and Remote Sensing*, (997, 5284): 149-159

Zeitler W., Dörstel C., Jacobsen K. (2002): Geometric calibration of the DMC: Method and Results, *Proceedings ASPRS*, Denver, USA.

Ryan R., Pagnutti M. (2009): Enhanced Absolute and Relative Radiometric Calibration for Digital Aerial Cameras, in: Fritsch D. (Ed.), *Photogrammetric Week 2009*, Wichmann-Verlag, pp. 81-90.

Doering D., Hildebrand J., Dietsch N. (2009): Advantages of customized optical design for aerial survey cameras, in: Fritsch D. (Ed.), *Photogrammetric Week 2009*, Wichmann-Verlag, pp. 69-80.

Stoldt, H. (2010): DALSA Ultra large CCD technology Customized for Aerial Photogrammetry. At: *ASPRS 2010*, San Diego, USA, p. 15.

## State of West Virginia

# VENDOR PREFERENCE CERTIFICATE

Certification and application\* is hereby made for Preference in accordance with **West Virginia Code**, §5A-3-37. (Does not apply to construction contracts). **West Virginia Code**, §5A-3-37, provides an opportunity for qualifying vendors to request (at the time of bid) preference for their residency status. Such preference is an evaluation method only and will be applied only to the cost bid in accordance with the **West Virginia Code**. This certificate for application is to be used to request such preference. The Purchasing Division will make the determination of the Vendor Preference, if applicable.

1. **Application is made for 2.5% vendor preference for the reason checked:**

- \_\_\_\_ Bidder is an individual resident vendor and has resided continuously in West Virginia for four (4) years immediately preceding the date of this certification; **or**,  
 \_\_\_\_ Bidder is a partnership, association or corporation resident vendor and has maintained its headquarters or principal place of business continuously in West Virginia for four (4) years immediately preceding the date of this certification; or 80% of the ownership interest of Bidder is held by another individual, partnership, association or corporation resident vendor who has maintained its headquarters or principal place of business continuously in West Virginia for four (4) years immediately preceding the date of this certification; **or**,  
 \_\_\_\_ Bidder is a nonresident vendor which has an affiliate or subsidiary which employs a minimum of one hundred state residents and which has maintained its headquarters or principal place of business within West Virginia continuously for the four (4) years immediately preceding the date of this certification; **or**,

2.  **Application is made for 2.5% vendor preference for the reason checked:**

- \_\_\_\_ Bidder is a resident vendor who certifies that, during the life of the contract, on average at least 75% of the employees working on the project being bid are residents of West Virginia who have resided in the state continuously for the two years immediately preceding submission of this bid; **or**,

3. **Application is made for 2.5% vendor preference for the reason checked:**

- \_\_\_\_ Bidder is a nonresident vendor employing a minimum of one hundred state residents or is a nonresident vendor with an affiliate or subsidiary which maintains its headquarters or principal place of business within West Virginia employing a minimum of one hundred state residents who certifies that, during the life of the contract, on average at least 75% of the employees or Bidder's affiliate's or subsidiary's employees are residents of West Virginia who have resided in the state continuously for the two years immediately preceding submission of this bid; **or**,

4. **Application is made for 5% vendor preference for the reason checked:**

- \_\_\_\_ Bidder meets either the requirement of both subdivisions (1) and (2) or subdivision (1) and (3) as stated above; **or**,

5. **Application is made for 3.5% vendor preference who is a veteran for the reason checked:**

- \_\_\_\_ Bidder is an individual resident vendor who is a veteran of the United States armed forces, the reserves or the National Guard and has resided in West Virginia continuously for the four years immediately preceding the date on which the bid is submitted; **or**,

6. **Application is made for 3.5% vendor preference who is a veteran for the reason checked:**

- \_\_\_\_ Bidder is a resident vendor who is a veteran of the United States armed forces, the reserves or the National Guard, if, for purposes of producing or distributing the commodities or completing the project which is the subject of the vendor's bid and continuously over the entire term of the project, on average at least seventy-five percent of the vendor's employees are residents of West Virginia who have resided in the state continuously for the two immediately preceding years.

7. **Application is made for preference as a non-resident small, women- and minority-owned business, in accordance with West Virginia Code §5A-3-59 and West Virginia Code of State Rules.**

- \_\_\_\_ Bidder has been or expects to be approved prior to contract award by the Purchasing Division as a certified small, women- and minority-owned business.

Bidder understands if the Secretary of Revenue determines that a Bidder receiving preference has failed to continue to meet the requirements for such preference, the Secretary may order the Director of Purchasing to: (a) reject the bid; or (b) assess a penalty against such Bidder in an amount not to exceed 5% of the bid amount and that such penalty will be paid to the contracting agency or deducted from any unpaid balance on the contract or purchase order.

By submission of this certificate, Bidder agrees to disclose any reasonably requested information to the Purchasing Division and authorizes the Department of Revenue to disclose to the Director of Purchasing appropriate information verifying that Bidder has paid the required business taxes, provided that such information does not contain the amounts of taxes paid nor any other information deemed by the Tax Commissioner to be confidential.

**Under penalty of law for false swearing (West Virginia Code, §61-5-3), Bidder hereby certifies that this certificate is true and accurate in all respects; and that if a contract is issued to Bidder and if anything contained within this certificate changes during the term of the contract, Bidder will notify the Purchasing Division in writing immediately.**

Bidder: The Thrasher Group Inc Signed: Chad Beller

Date: 10/28/2015 Title: PTC

RFQ No. 16000000014

STATE OF WEST VIRGINIA  
Purchasing Division  
**PURCHASING AFFIDAVIT**

**MANDATE:** Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

**EXCEPTION:** The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

**DEFINITIONS:**

**"Debt"** means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

**"Employer default"** means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

**"Related party"** means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

**AFFIRMATION:** By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (W. Va. Code §61-5-3) that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

**WITNESS THE FOLLOWING SIGNATURE:**

Vendor's Name: The Thrasher Group, Inc.

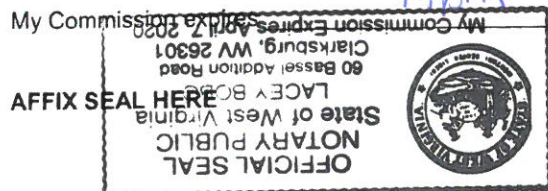
Authorized Signature: Chad Biller Date: 10/28/2015

State of West Virginia

County of Harrison, to-wit:

Taken, subscribed, and sworn to before me this 28 day of October, 2015.

My Commission Expires April 7, 2020.



NOTARY PUBLIC [Signature]

**CERTIFICATION AND SIGNATURE PAGE**

By signing below, or submitting documentation through wvOASIS, I certify that I have reviewed this Solicitation in its entirety; understand the requirements, terms and conditions, and other information contained herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

The Thrasher Group, Inc.  
(Company)

Chad Bellan, PIC  
(Authorized Signature) (Representative Name, Title)

304-624-4108 304-624-7831 10/28/2015  
(Phone Number) (Fax Number) (Date)

**ADDENDUM ACKNOWLEDGEMENT FORM**  
**SOLICITATION NO.:** 16000000016

**Instructions:** Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

**Acknowledgment:** I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

**Addendum Numbers Received:**

(Check the box next to each addendum received)

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6  |
| <input type="checkbox"/> Addendum No. 2            | <input type="checkbox"/> Addendum No. 7  |
| <input type="checkbox"/> Addendum No. 3            | <input type="checkbox"/> Addendum No. 8  |
| <input type="checkbox"/> Addendum No. 4            | <input type="checkbox"/> Addendum No. 9  |
| <input type="checkbox"/> Addendum No. 5            | <input type="checkbox"/> Addendum No. 10 |

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

The Thrasher Group, Inc.

Company

Chad Bellec

Authorized Signature

10/28/2015

Date

NOTE: This addendum acknowledgment should be submitted with the bid to expedite document processing.  
Revised 6/8/2012

# CERTIFICATE OF *Authorization*

STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

*The West Virginia State Board of Registration for Professional Engineers  
having verified the person in responsible charge is registered in  
West Virginia as a professional engineer for the noted firm, hereby certifies*

**THE THRASHER GROUP, INC.**

**C00517-00**

**Engineer in Responsible Charge: H. WOOD THRASHER - WV PE 009478**

*has complied with section §30-13-17 of the West Virginia Code governing  
the issuance of a Certificate of Authorization. The Board hereby notifies you of its  
certification with issuance of this Certification of Authorization for the period of:*

**July 1, 2014 - June 30, 2015**

*providing for the practice of engineering services in the State of West Virginia.*

IF YOU ARE REQUIRED TO REGISTER WITH THE SECRETARY OF STATE'S OFFICE,  
PLEASE SUBMIT THIS CERTIFICATE WITH YOUR APPLICATION.



IN TESTIMONY WHEREOF, THE WEST VIRGINIA STATE BOARD OF  
REGISTRATION FOR PROFESSIONAL ENGINEERS HAS ISSUED THIS COA  
UNDER ITS SEAL AND SIGNED BY THE PRESIDENT OF SAID BOARD.

A stylized, handwritten signature in black ink, appearing to be "H. Wood Thrasher", written over a horizontal line.

BOARD PRESIDENT



WEST VIRGINIA  
BOARD OF PROFESSIONAL SURVEYORS

*Certificate of Authorization*

2015

ISSUED TO:

**THE THRASHER GROUP, INC.**  
Bridgeport, West Virginia

CERTIFICATE OF AUTHORIZATION No. **15-5433**

This certificate is issued by the West Virginia Board of Professional Surveyors in accordance with *West Virginia Code § 30-13A-20*  
The person or organization identified on this certificate is licensed to conduct professional surveying and mapping services  
in the State of West Virginia for the period

**January 1, 2015 through December 31, 2015**

*This certificate is not transferrable and must be displayed at the office location for which issued.*

In witness whereof I have put my hand, this 18<sup>th</sup> day of November, 2014

ROY E. SHREWSBURY, II, Chairman

MARK H. HORNISH



R. MICHAEL SHEPP

NELSON B. DOUGLASS, Secretary

ANTHONY J. SPARACINO