

CECW-EE

Manual
 No. 1110-1-1000

1 July 2002

**Engineering and Design
 PHOTOGRAMMETRIC MAPPING**

Subject	Paragraph	Page
Chapter 1		
Introduction		
Purpose	1-1	1-1
Applicability	1-2	1-1
Distribution	1-3	1-1
References	1-4	1-1
Mandatory Requirements	1-5	1-1
Scope	1-6	1-1
Standards	1-7	1-2
Life Cycle Project Management Integration of Photogrammetric Mapping		
Throughout the Project Life	1-8	1-3
Metrics.....	1-9	1-4
Trade Name Exclusions	1-10	1-4
Manual Development and Proponency	1-11	1-5
Using the Manual	1-12	1-5
Explanation of Abbreviations and Terms.....	1-13	1-6
Mandatory Requirements of this Chapter.....	1-14	1-6
Chapter 2		
Photogrammetric Accuracy Standards and Classifications		
General	2-1	2-1
Photogrammetric Mapping Standards	2-2	2-2
USACE Photogrammetric Mapping Standard.....	2-3	2-7
ASPRS Accuracy Standards for Large-Scale Maps	2-4	2-9
Typical Mapping Scales, Contour Intervals, and Accuracy Classifications		
for USACE Functional Applications.....	2-5	2-11
Supplemental USACE Photogrammetric Mapping Criteria.....	2-6	2-12
USACE Orthophoto and Orthophoto Map Accuracy Standards.....	2-7	2-15
Photogrammetric Mapping Coverage	2-8	2-16
Mandatory Requirements in Chapter 2	2-9	2-17
Chapter 3		
Photogrammetric Processes		
Photogrammetry	3-1	3-1
Photogrammetric Processes.....	3-2	3-1
Imagery Acquisition.....	3-3	3-1

Subject	Paragraph	Page
Ground Control	3-4	3-3
Adjustment of Imagery to the Earth	3-5	3-4
Feature Collection	3-6	3-6
Quality Control / Quality Assurance	3-7	3-7

Chapter 4

Photogrammetric Mapping Planning and Cost Estimating Principles

General	4-1	4-1
Photogrammetric Mapping Project Planning	4-2	4-1
Photo Scale, Contour Interval, and Target Map Scale Determination	4-3	4-2
Data Compatibility	4-4	4-21
Project Design	4-5	4-22
Photogrammetric Mapping Production Flow	4-6	4-24
Approach to Estimating Detailed Photogrammetric Mapping Project Costs	4-7	4-24
Project Specifications	4-8	4-26
Contract Parameters	4-9	4-26
Calculation of Production Hours for Aerial Photography	4-10	4-28
Photo Control Surveying Cost Items	4-11	4-29
Aerotriangulation	4-12	4-29
Photogrammetric Compilation and Digital Mapping Cost Items	4-13	4-30
Orthophoto Images	4-14	4-32
Summary of Production Hours	4-15	4-32
Photogrammetric Mapping - Sample Scope of Work and Cost Estimate	4-16	4-33

Chapter 5

Aerial Photography

General	5-1	5-1
Subcontracted Photography	5-2	5-2
General	5-3	5-2
Operational Procedures	5-4	5-2
Flight Line Maps	5-5	5-6
General	5-6	5-7
Types of Aerial Cameras	5-7	5-9
Analog Aerial Cameras	5-8	5-9
Camera Filters	5-9	5-9
Camera Classifications	5-10	5-10
Camera Mounting Requirements	5-11	5-10
Camera Criteria/Reporting	5-12	5-10
General	5-13	5-11
Radiant Energy and the Electromagnetic Spectrum	5-14	5-11
Film Characteristics	5-15	5-13
Type of Diapositives	5-16	5-13
Film Processing and Handling Specifications and Criteria	5-17	5-13
Camera Panel	5-18	5-15
Film Report	5-19	5-15
Negative Annotation	5-20	5-15
Container Labels	5-21	5-16
Photo Index Map Requirements	5-22	5-16

Subject.....	Paragraph	Page
Contact Prints	5-23	5-17
Contract Deliverables	5-24	5-17
 Chapter 6		
Structural Evaluation		
General	6-1	6-1
Coordinate Reference Systems.....	6-2	6-1
Ground Control Requirements for Photogrammetric Mapping.....	6-3	6-1
Marking Photo Control.....	6-4	6-7
Survey Accuracy Standards.....	6-5	6-11
Deliverables.....	6-6	6-12
 Chapter 7		
Airborne Global Positioning System Techniques		
ABGPS	7-1	7-1
Project Planning	7-2	7-1
Other Considerations.....	7-3	7-2
Ground Receiver	7-4	7-3
Airborne Receiver	7-5	7-3
ABGPS Project Configuration	7-6	7-5
Quality Control.....	7-7	7-5
 Chapter 8		
Analytical Aerotriangulation		
General	8-1	8-1
Aerotriangulation Principles.....	8-2	8-1
Softcopy Methods	8-3	8-1
Pass Points.....	8-4	8-2
Ground Control Points	8-5	8-3
Other Points.....	8-6	8-5
Instrumentation.....	8-7	8-5
Accuracy and Quality Control Criteria	8-8	8-5
Stereoplotter Settings	8-9	8-8
Deliverables.....	8-10	8-8
 Chapter 9		
Stereocompilation Procedures		
General	9-1	9-1
Preparation	9-2	9-1
Stereoplatters	9-3	9-2
Types of Stereoplotters.....	9-4	9-2
Stereoplotter Operations.....	9-5	9-3
Stereoplotter Output Devices	9-6	9-4
Softcopy Workstation.....	9-7	9-5
Softcopy Workstations Output Devices	9-8	9-5
Stereoplotter Accuracies.....	9-9	9-5
Line Map Compilation Procedures.....	9-10	9-7
Compilation of Topography	9-11	9-8
Map Manuscript	9-12	9-11

Subject	Paragraph	Page
Map Edit.....	9-13	9-12
Reproduction.....	9-14	9-14
Deliverables.....	9-15	9-14

Chapter 10
Orthophotographs

Orthophotographs.....	10-1	10-1
Background.....	10-2	10-1
Current Status.....	10-3	10-2
Map Substitute.....	10-4	10-3
Image Quality.....	10-5	10-3
Workstations.....	10-6	10-4
Production Procedures.....	10-7	10-5
Enlargement Factor.....	10-8	10-8
Limitation of Orthophotography.....	10-9	10-8

Chapter 11
Airborne LIDAR Topographic Surveying

General.....	11-1	11-1
Operating Principles.....	11-2	11-1
Uses of LIDAR within the Corps.....	11-3	11-2
Background.....	11-4	11-3
Capabilities and Limitations.....	11-5	11-3
Comparisons with Existing Technologies.....	11-6	11-3
LIDAR System Components.....	11-7	11-4
Planning a LIDAR Data Collection.....	11-8	11-6
LIDAR Data Collection.....	11-9	11-7
LIDAR Data Processing.....	11-10	11-9
Results.....	11-11	11-9
Data Classification.....	11-12	11-10
Quality Control.....	11-13	11-11
Contracting Issues.....	11-14	11-11
Sources of Additional Information.....	11-15	11-12

Appendix A
References

Appendix B
Planimetric and Topographic Feature
Depiction Specifications

Appendix C
Guide Specification for Photogrammetric
Mapping and Aerial Photography Services

Appendix D
ASPRS Accuracy Standards
for Large-Scale Maps

Appendix E
Sample Metadata File

Appendix F
Sample SOW

Glossary