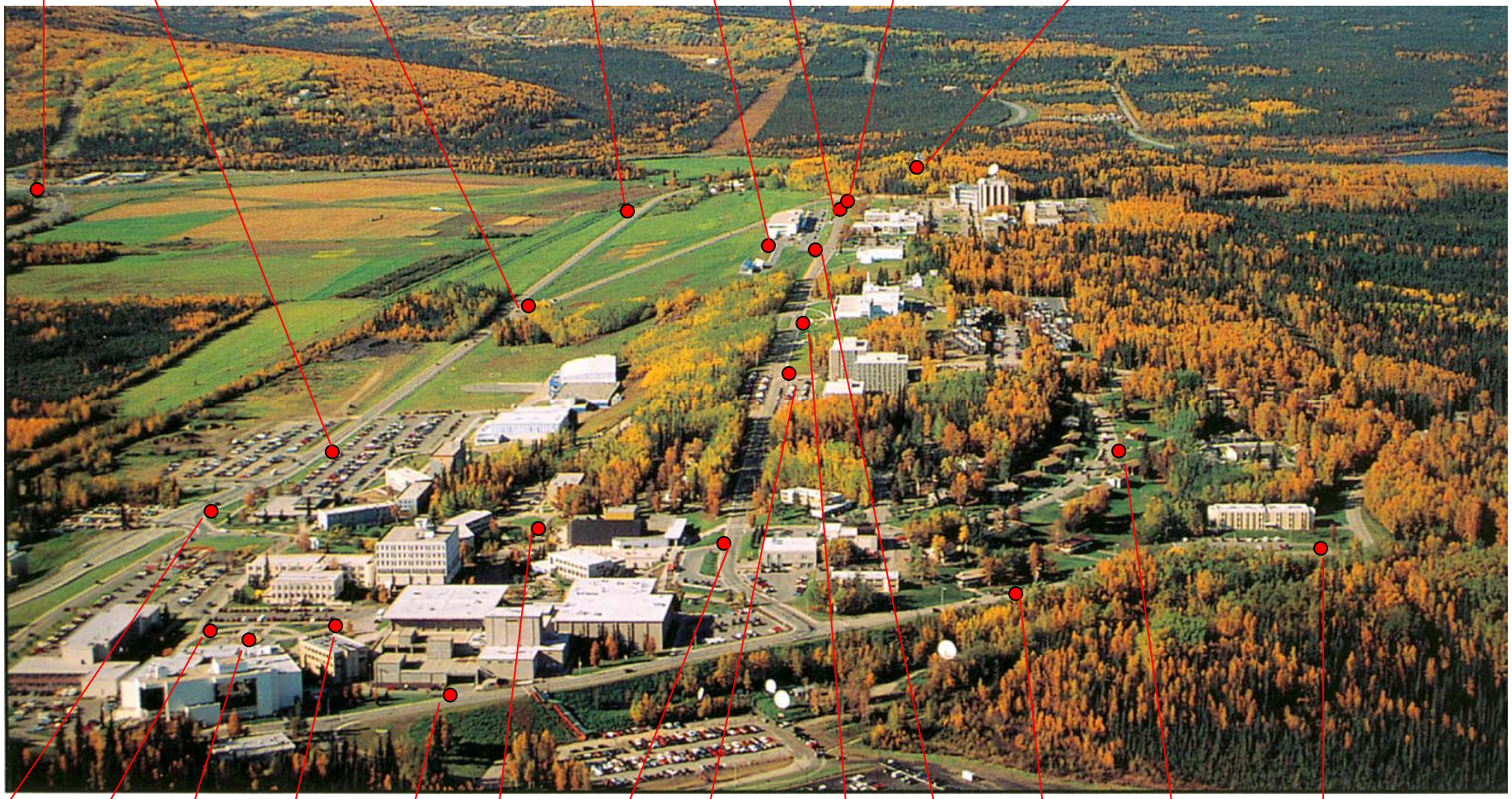
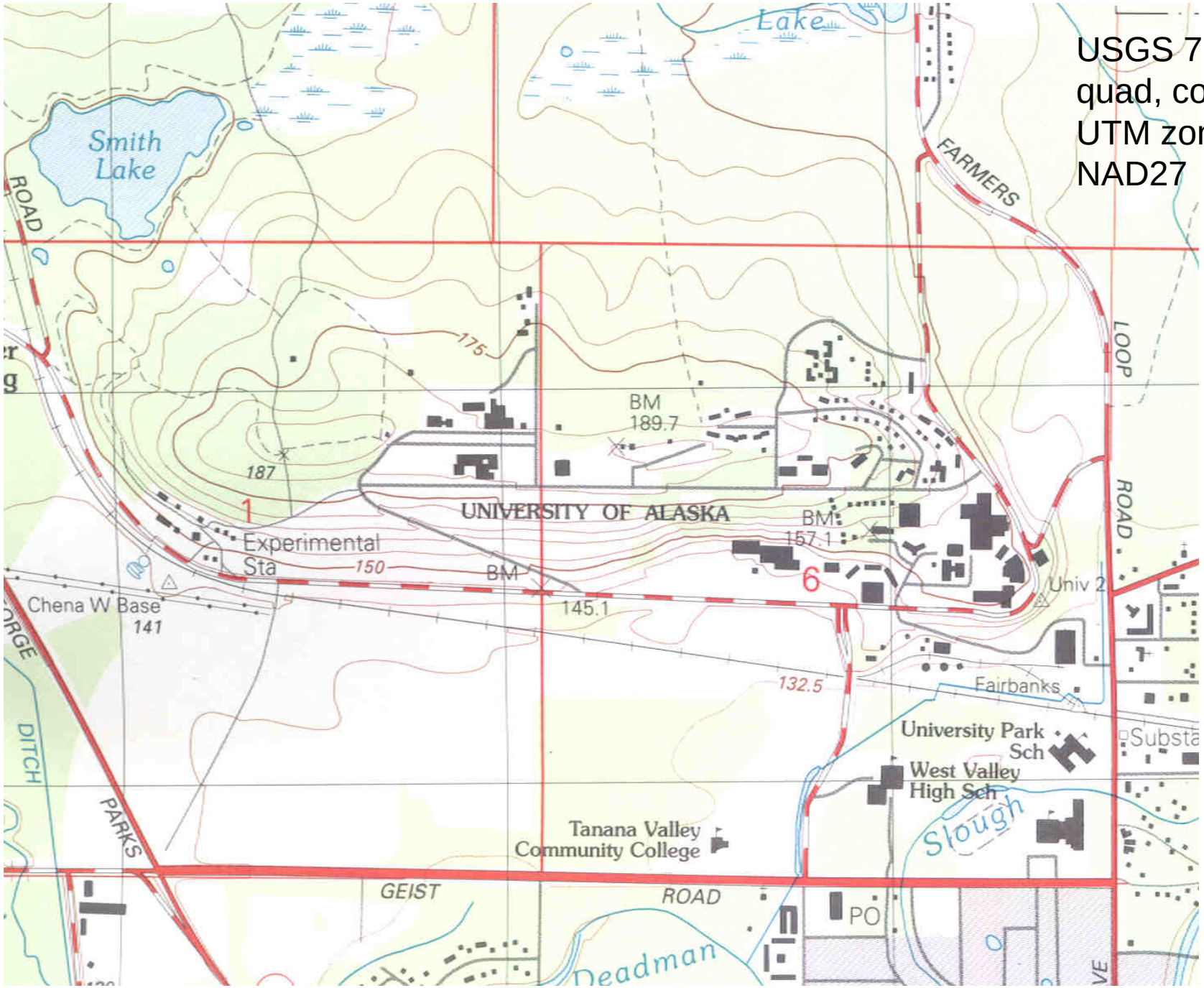
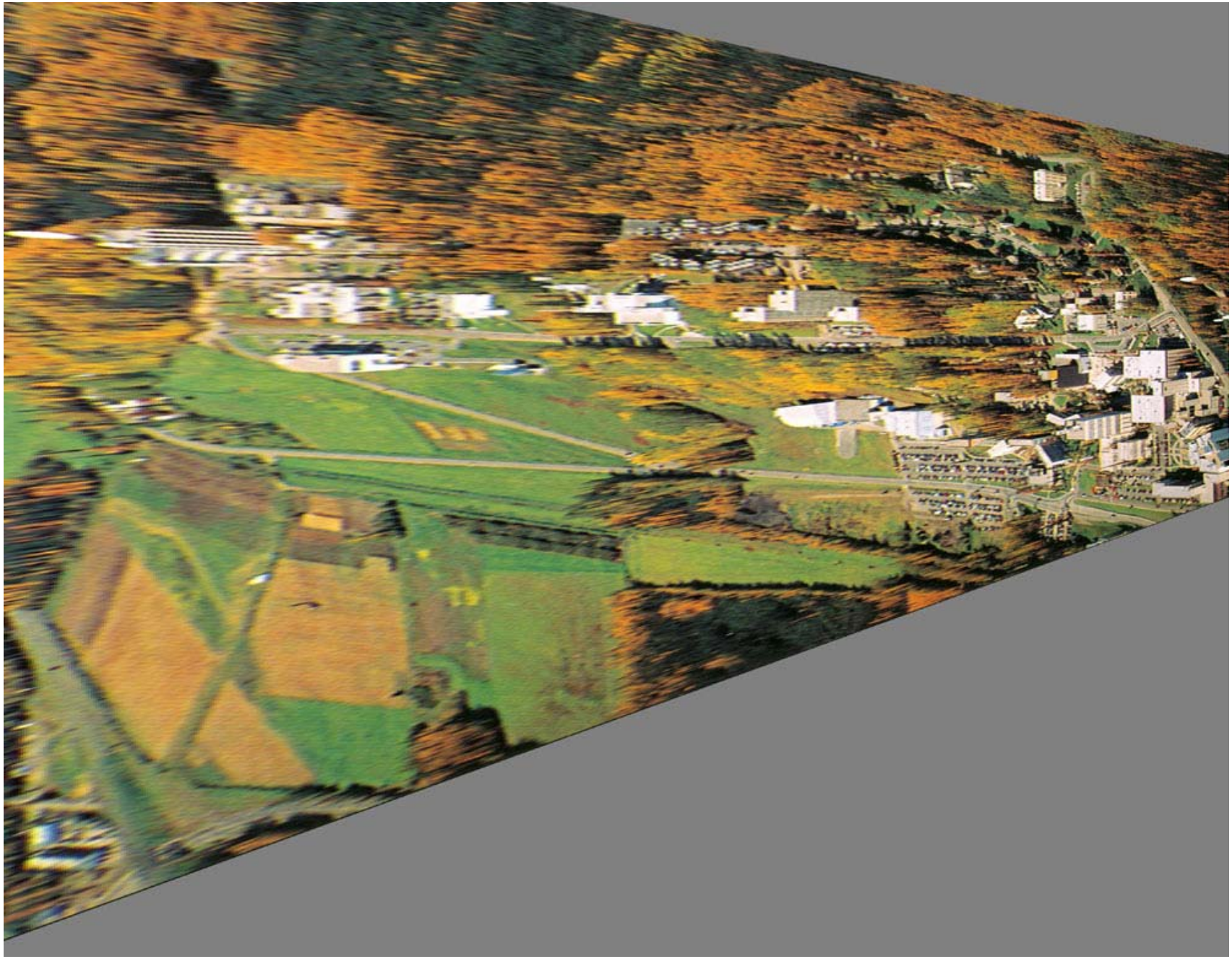
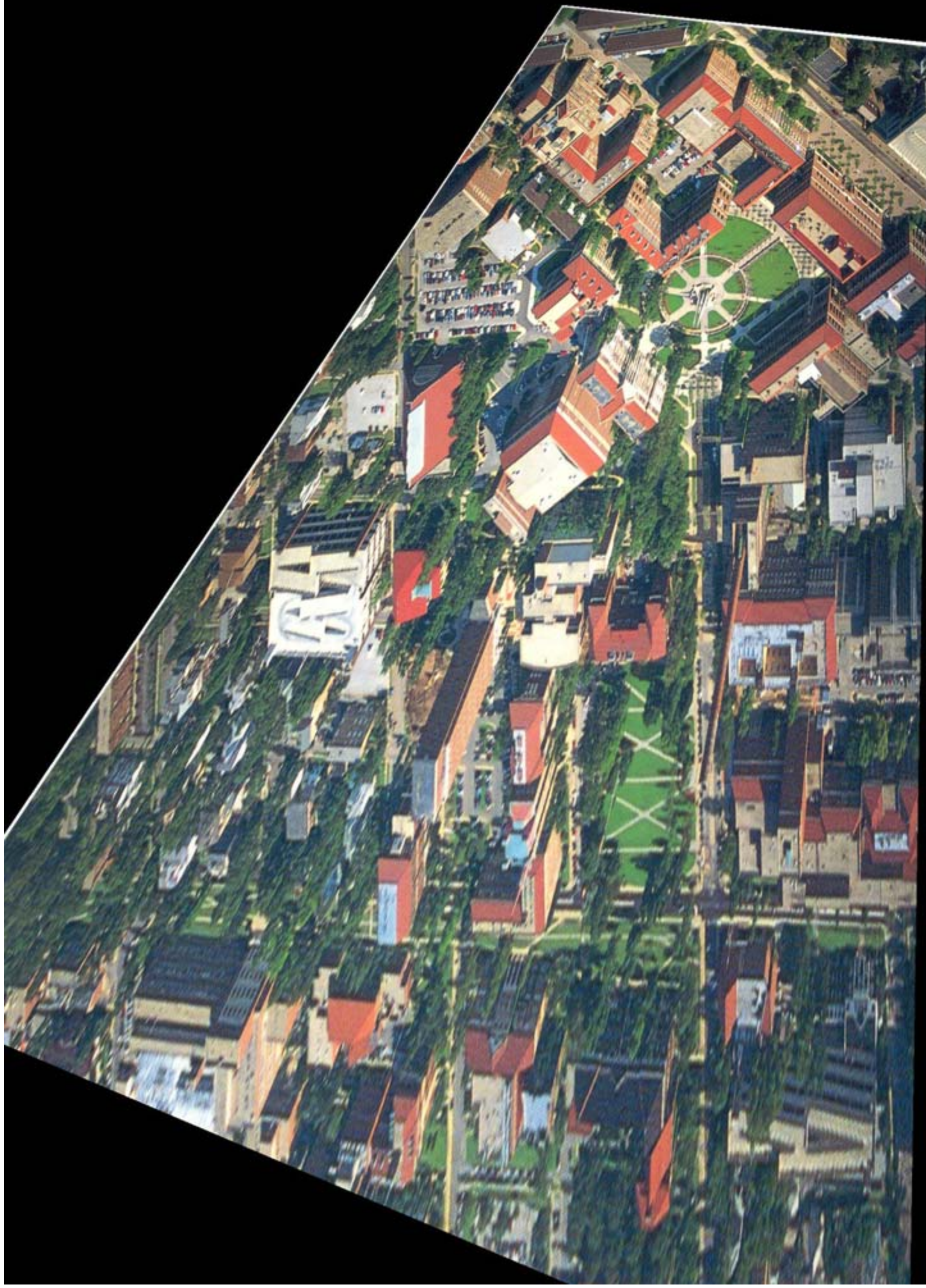
Some Examples of Rectification

Control Points for UAF Campus Oblique Rectification Project



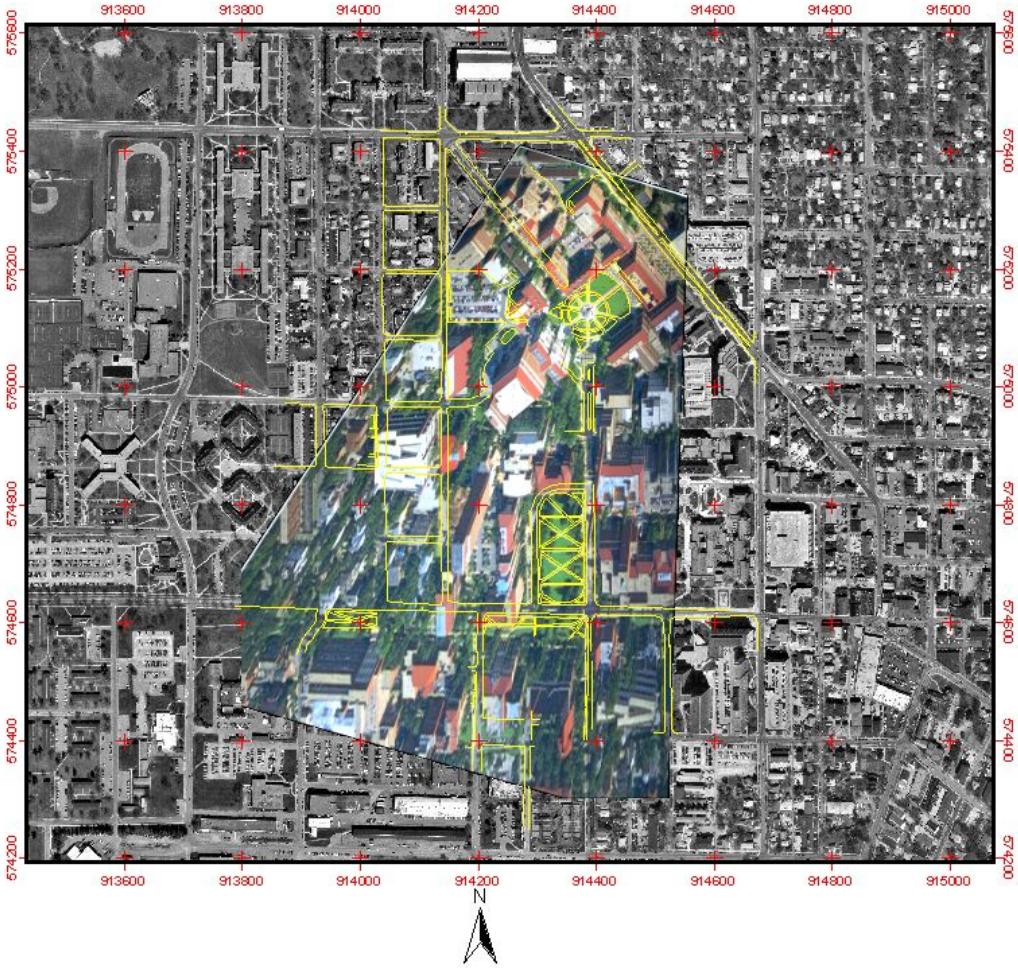

USGS 7.5min
quad, coords
UTM zone-6
NAD27
N
E
7193000 m
7192000 m
459000 m
460000 m
461000 m
Smith Lake
Lake
FARMERS
LOOP
ROAD
BM
189.7
187
175
UNIVERSITY OF ALASKA
BM
157.1
Experimental
Sta
150
BM
145.1
Chena W Base
141
Univ 2
132.5
Fairbanks
University Park
Sch
West Valley
High Sch
Substa
Tanana Valley
Community College
GEIST
ROAD
PO
Deadman
Slough
DITCH
PARKS



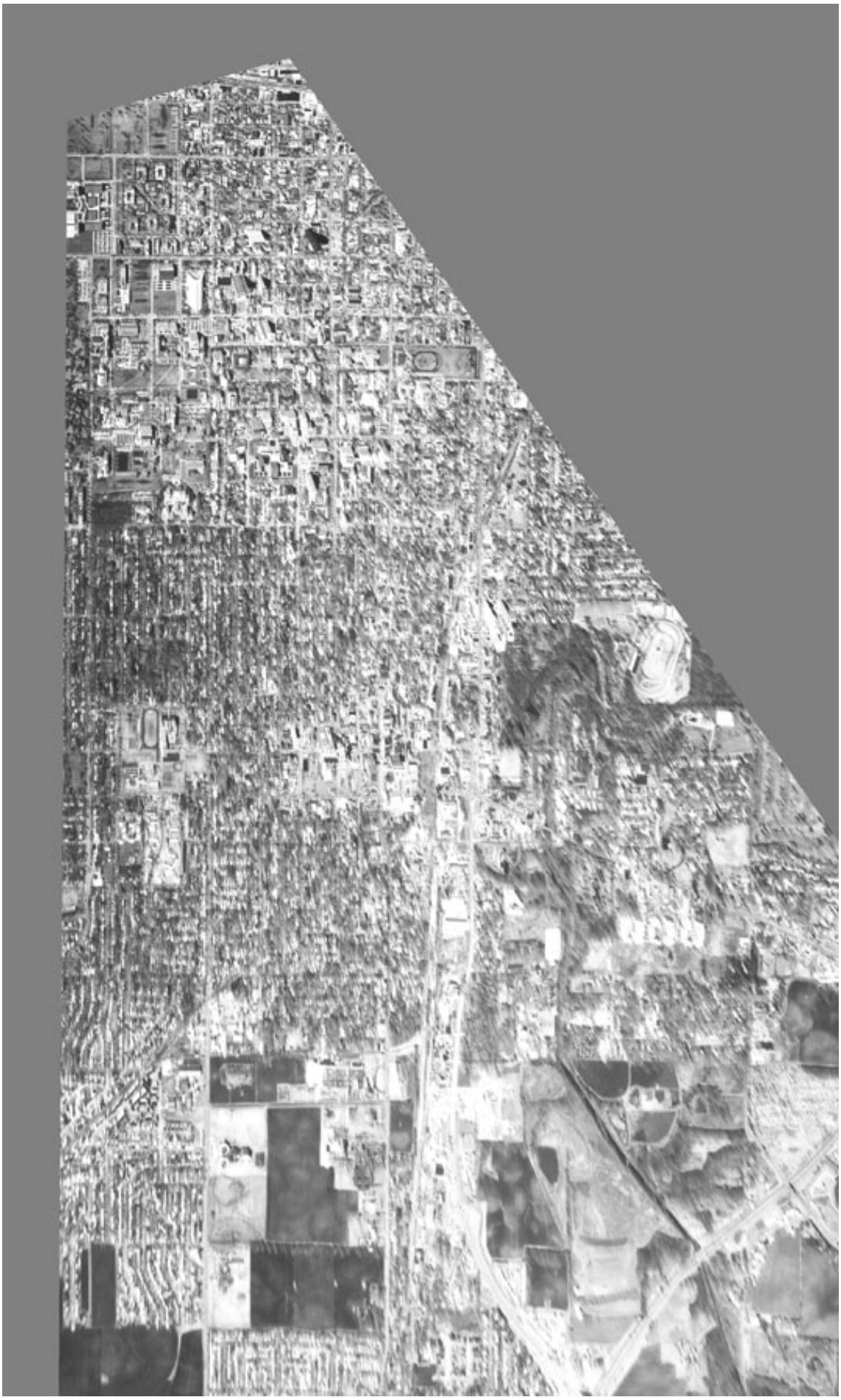


Composite Map of Purdue University and Vicinity

For: CE503, Fall 2004
By: Patrick Gies
Date: 9/17/2004



Description: The map displayed above is a representation of Purdue Univeristy and its immediate vicinity. It was created by overlaying a rectified color oblique image onto a larger monochrome reference image. The reference image used the Indiana State Plane coordinate system. The oblique image was scanned from a University postcard and then rectified to the Indiana State Plane system using an 8-parameter transform. The grid values in red represent the North and East coordinates of the image in the Indiana State Plane system with the lower left of this image at 574200 North and 913450 East. A partial road network has been drawn in yellow.



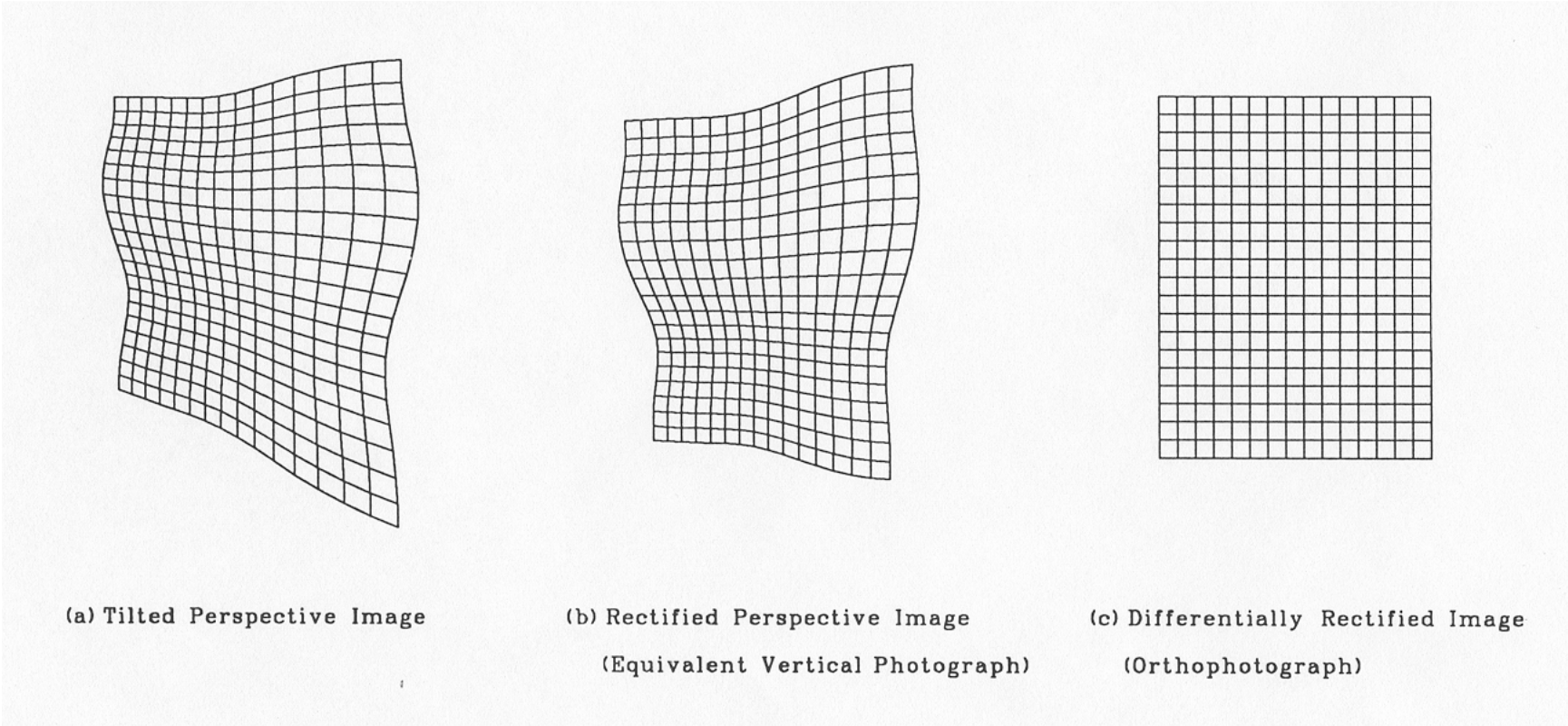
Raw HYDICE Imagery, Ft. Hood

Orthorectified HYDICE Imagery

Raw HYDICE Imagery, Wash. D.C.

Orthorectified HYDICE Imagery

Image Rectification and Orthorectification



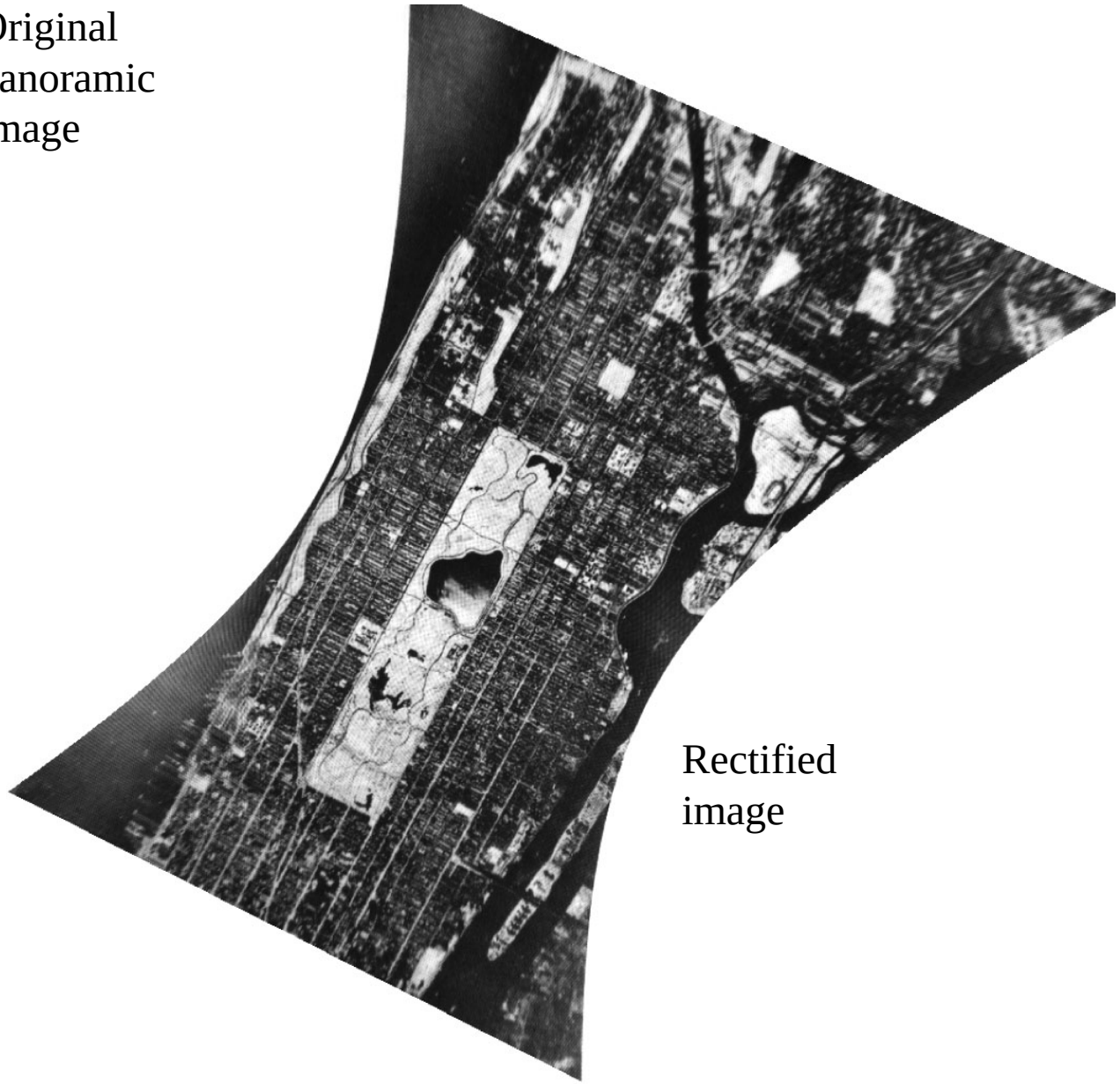
(a) Tilted Perspective Image

(b) Rectified Perspective Image
(Equivalent Vertical Photograph)

(c) Differentially Rectified Image
(Orthophotograph)

Panoramic Geometry - Manhattan & New York City Area

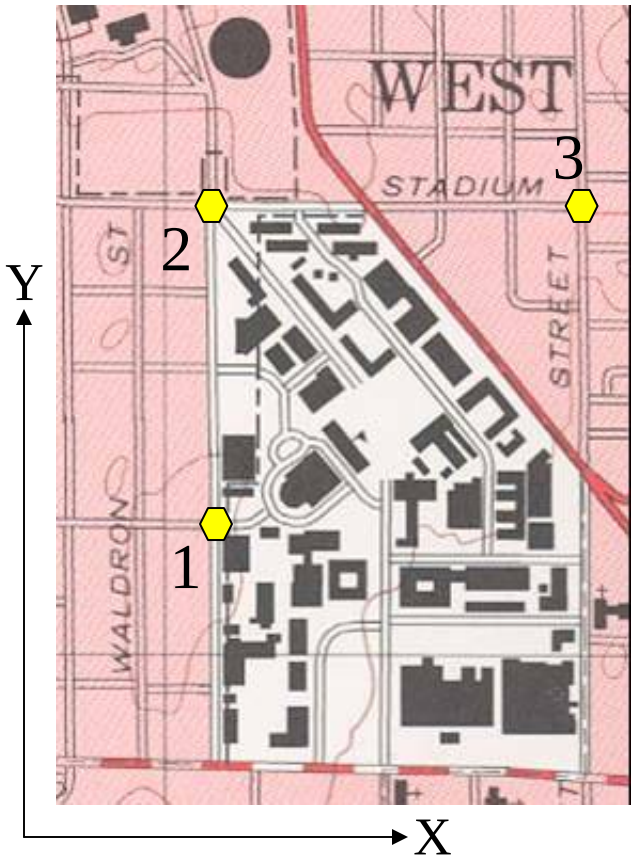
Original panoramic image



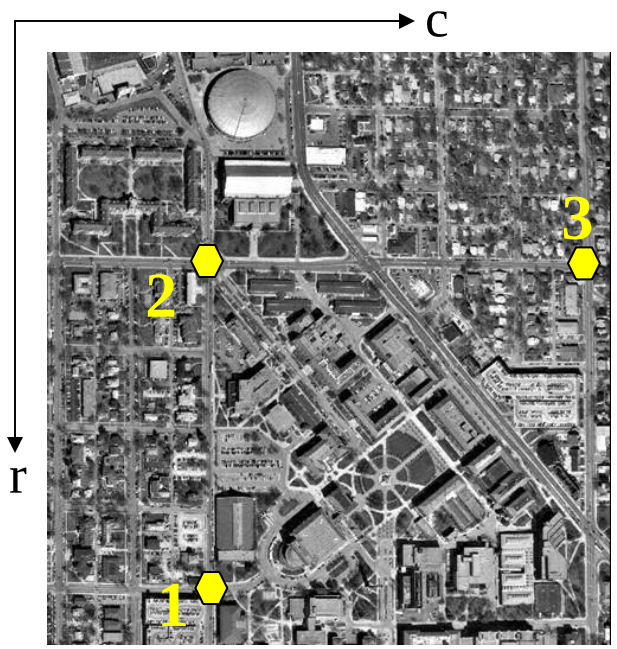
Rectified image

Example of rectification where sampling rate is different in different parts of the image

Mapping Polynomials or Rubber Sheeting



Map



Image

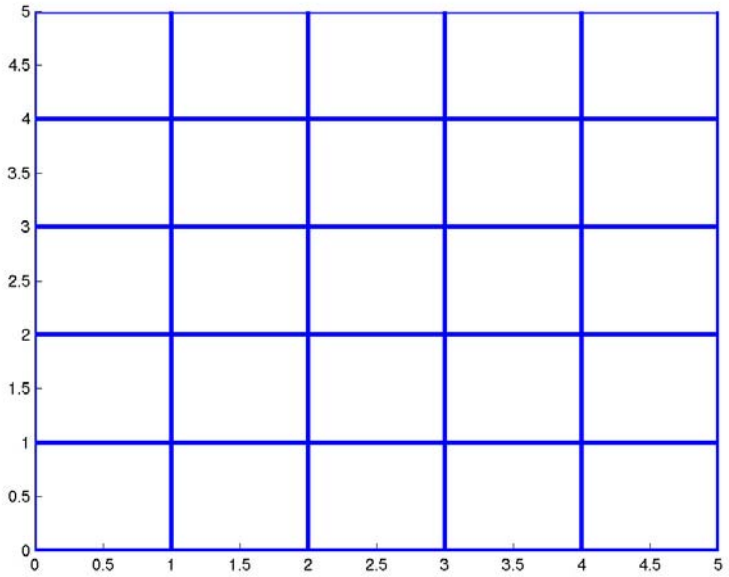
$$r = a_0 + a_1 X + a_2 Y + a_3 XY + a_4 X^2 + a_5 Y^2$$

$$c = b_0 + b_1 X + b_2 Y + b_3 XY + b_4 X^2 + b_5 Y^2$$

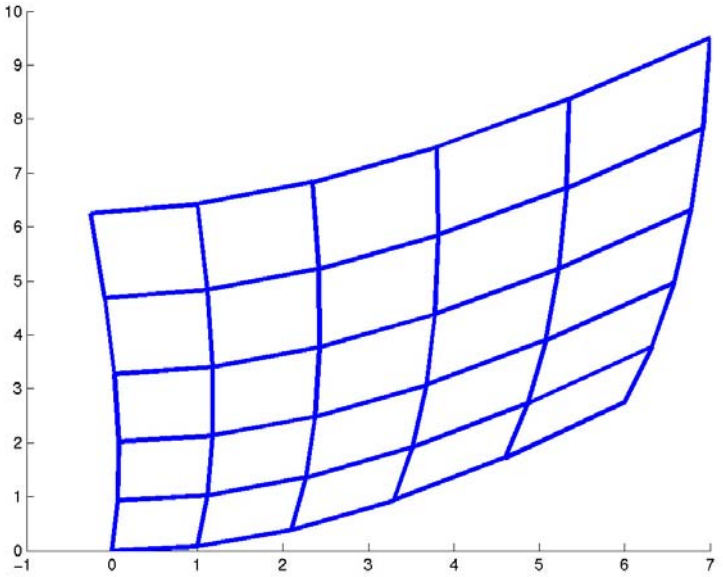
For each point we create two equations. We need at least as many equations as unkowns. If more, then we use least squares. It is like a regression problem: linear, easy. But we are confounding the effects of sensor, platform motion, and terrain relief. What should be the order of the polynomial ?

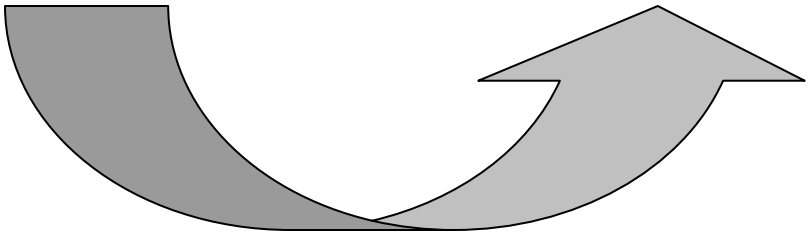
Graphical View of Rubber Sheet Transformation (2nd order, 12-parameter)

Reference grid

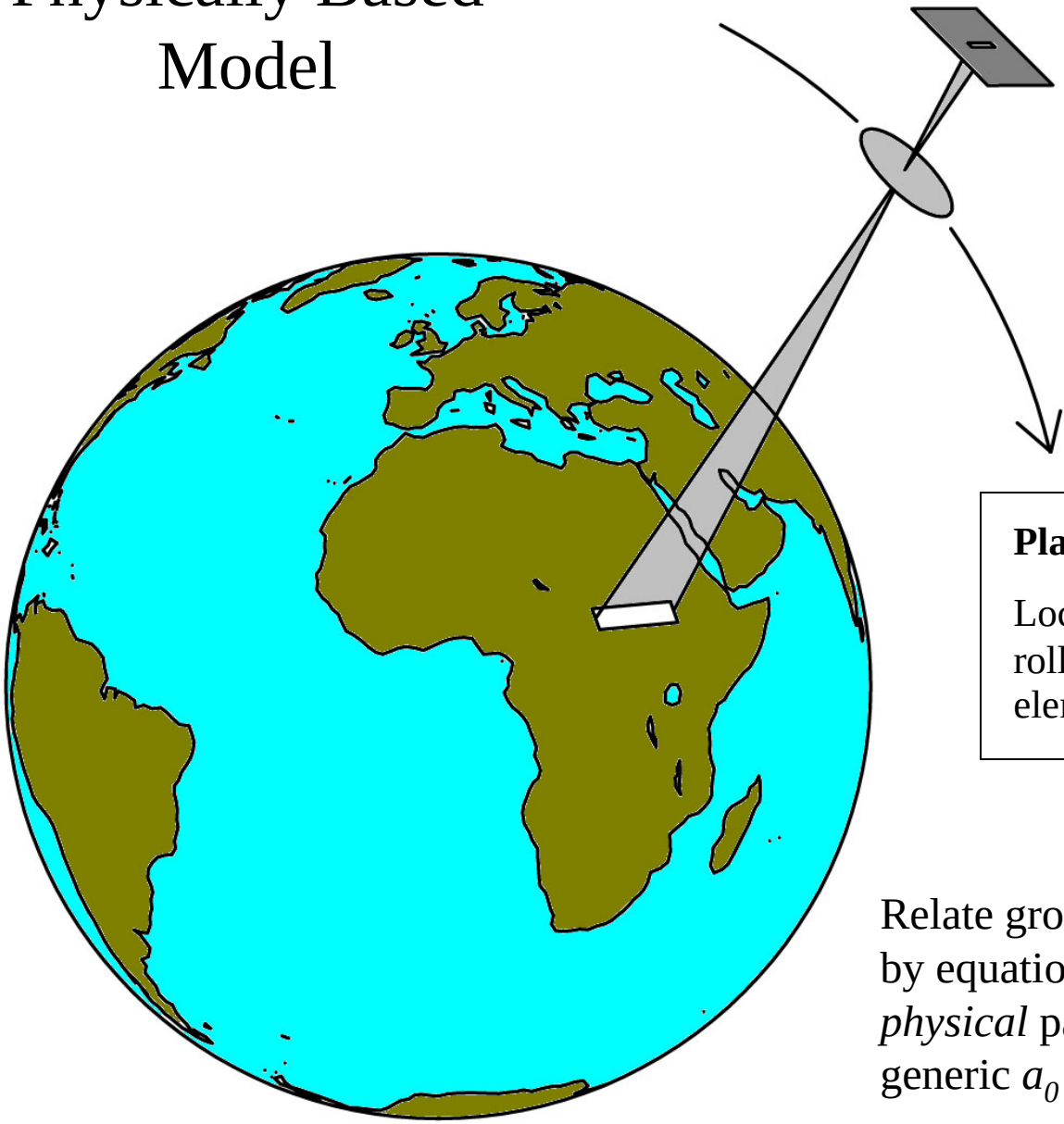


Transformed grid





Physically Based Model



Sensor parameters:

Focal length, principal point location, lens distortion, line rate, detector (pixel) size

Platform parameters:

Location X,Y,Z, time, attitude roll, pitch, yaw, kepler orbit elements (a,e,i,Ω,ω,ν)

Relate ground point and image point by equations with the above *actual physical* parameters, rather than the generic a_0 , a_1 , a_2 , … parameters.