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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
61/197,904	10/31/2008		110	290115.403P1		

CONFIRMATION NO. 8081

FILING RECEIPT



500
SEED INTELLECTUAL PROPERTY LAW GROUP PLLC
701 FIFTH AVE
SUITE 5400
SEATTLE, WA 98104

Date Mailed: 12/18/2008

Receipt is acknowledged of this provisional patent application. It will not be examined for patentability and will become abandoned not later than twelve months after its filing date. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Chris Pershing, Bellevue, WA;
David P. Carlson, Woodinville, WA;

Power of Attorney: None

If Required, Foreign Filing License Granted: 12/15/2008

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 61/197,904**

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

User interface techniques for roof estimation

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. **EV934844164US**

INVENTOR(S)					
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)			
Chris David P.	Pershing Carlson	Bellevue, WA Woodinville, WA			
Additional inventors are being named on the _____ separately numbered sheets attached hereto					
TITLE OF THE INVENTION (500 characters max)					
USER INTERFACE TECHNIQUES FOR ROOF ESTIMATION					
CORRESPONDENCE ADDRESS					
Direct all correspondence to:					
☒ The address corresponding to Customer Number: 00500					
OR					
☐ Firm or Individual Name					
Address					
City		State		ZIP	
Country		Telephone		Email	
ENCLOSED APPLICATION PARTS (check all that apply)					
☒ Application Data Sheet. See 37 CFR 1.76		☐ CD(s), Number of CDs _____			
☒ Specification Number of Pages 39		☒ Other (specify) Return Receipt Postcard			
☒ Drawing(s) Number of Sheets 23		Fee Transmittal			
Fees Due: Filing Fee of \$220 (\$110 for small entity). If the specification and drawings exceed 100 sheets of paper, an application size fee is also due, which is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).					
METHOD OF PAYMENT OF THE FILING FEE AND APPLICATION SIZE FEE FOR THIS PROVISIONAL APPLICATION FOR PATENT					
☒ Applicant claims small entity status. See 37 CFR 1.27.				Total Fee Amount	
☒ A check or money order is enclosed to cover the filing fee and application size fee (if applicable)				\$110	
☐ Payment by credit card. Form PTO-2038 is attached.					
☒ The Director is hereby authorized to charge the filing fee and application size fee (if applicable) or credit any overpayment to Deposit Account Number: 19-1090 .					
The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.					
☒ No.					
☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____					

SIGNATURE

TYPED or

PRINTED NAME

TELEPHONE

David V. Carlson

David V. Carlson

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Date

REGISTRATION

NO.

Docket Number:

October 31, 2008

31,153

290115.403P1

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.
1268933_1.DOC

Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

Complete if Known**FEE TRANSMITTAL
For FY 2009**

Application Number

Filing Date

October 31, 2008

First Named Inventor

Chris Pershing

Examiner Name

☒ Applicant claims small entity status. See 37 CFR 1.27

Art Unit

TOTAL AMOUNT OF PAYMENT (\$)**110**

Attorney Docket No.

290115.403P1

METHOD OF PAYMENT (check all that apply)☒ Check ☐ Credit Card ☐ Money Order ☐ Other (please identify): _____☒ Deposit Account Deposit Account Number: 19-1090 Deposit Account Name: Seed IP Law Group PLLC

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below☐ Charge fee(s) indicated below, **except for the filing fee**☐ Charge any additional fee(s) or underpayments☒ Charge any underpayments or credit any overpayments

of fee(s) under 37 CFR 1.16 and 1.17

Warning: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION**1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

FILING FEES

SEARCH FEES

EXAMINATION
FEES

Application Type	Fee (\$)	<u>Small Entity</u> Fee (\$)	<u>Small Entity</u> Fee (\$)	<u>Small Entity</u> Fee (\$)	<u>Small Entity</u> Fee (\$)	<u>Small Entity</u> Fee (\$)	Fees Paid (\$)
Utility	330	165	540	270	220	110	_____
Design	220	110	100	50	140	70	_____
Provisional	220	110	0	0	0	0	110

2. EXCESS CLAIM FEESFee DescriptionFee (\$)Small Entity
Fee (\$)

Each claim over 20 (including Reissues)

52

26

Each independent claim over 3 (including Reissues)

220

110

Multiple dependent claims

390

195

Total ClaimsExtra ClaimsFee (\$)Fee Paid (\$)Multiple Dependent Claims

_____ -20 or HP = _____ X _____ = _____

Fee (\$)Fee Paid (\$)

HP = highest number of total claims paid for, if greater than 20.

Indep. ClaimsExtra ClaimsFee (\$)Fee Paid (\$)

_____ -3 or HP = _____ X _____ = _____

HP = highest number of independent claims paid for, if greater than 3.

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total SheetsExtra SheetsNumber of each additional 50 or fraction thereofFee (\$)Fee Paid (\$)

_____ -100 = _____

/50 = _____

(round up to a whole number)

x _____

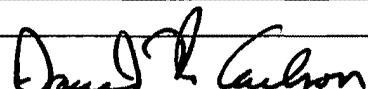
4. OTHER FEE(S)Fees Paid (\$)

Non-English Specification, \$130 fee (no small entity discount)

Other (e.g., late filing surcharge): _____

SUBMITTED BY

Signature

Registration No.
(Attorney/Agent)

31,153

Telephone

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Name (Print/Type)

David V. Carlson

Date

October 31, 2008

APPLICATION DATA SHEET**Application Information**

Application number::

Filing Date::

Application Type:: Provisional

Subject Matter:: Utility

Suggested classification::

Suggested Group Art Unit::

CD-ROM or CD-R?:: No

Number of CD disks::

Number of copies of CDs::

Sequence submission?:: No

Computer Readable Form (CRF)?:: No

Number of copies of CRF::

Title :: USER INTERFACE TECHNIQUES FOR ROOF
ESTIMATION

Attorney Docket Number:: 290115.403P1

Request for Early Publication?:: No

Request for Non-Publication?:: Yes

Suggested Drawing Figure::

Total Drawing Sheets:: 23

Small Entity?:: No

Petition included?:: No

Petition Type::

Licensed U.S. Gov't Agency:: No

Contract or Grant No::

Secrecy Order in Parent Appl.?:: No

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Correspondence Information

Correspondence Customer Number :: **00500**

Representative Information

Representative Customer Number::		00500
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Domestic Priority Information

Application ::	Continuity Type::	Parent Application::	Parent Filing Date::

Foreign Priority Information

Country::	Application number::	Filing Date::	Priority Claimed::

Assignee Information

Assignee name::	Eagle View Technologies, Inc.
Street of mailing address::	17401 NE 138th Street
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State or Province of mailing address::	WA
Country of mailing address::	US
Postal or Zip Code of mailing address::	98052

1268823_1.DOC

USER INTERFACE TECHNIQUES FOR ROOF ESTIMATION

FIELD OF THE INVENTION

This invention relates to systems and methods for estimating construction projects, and more particularly, to user interface systems and methods for generating a roof estimate report based on one or more aerial images of a roof of a building.

BACKGROUND

The information provided below is not admitted to be part of the present invention, but is provided solely to assist the understanding of the reader.

Homeowners typically ask several roofing contractors to provide written estimates to repair or replace a roof on a house. Heretofore, the homeowners would make an appointment with each roofing contractor to visit the house to determine the style of roof, take measurements, and to inspect the area around the house for access and cleanup. Using this information, the roofing contractor then prepares a written estimate and then timely delivers it to the homeowner. After receiving several estimates from different roofing contractors, the homeowner then selects one.

There are factors that impact a roofing contractor's ability to provide a timely written estimate. One factor is the size of the roof contractor's company and the location of the roofing jobs currently underway. Most roof contractors provide roofing services and estimates to building owners over a large geographical area. Larger roof contractor companies hire one or more trained individuals who travel throughout the entire area providing written estimates. With smaller roofing contractors, the owner or a key trained person is appointed to provide estimates. With both types of companies, roofing estimates are normally scheduled for buildings located in the same area on a particular day. If an estimate is needed suddenly at a distant location, the time for travel and the cost of

commuting can be prohibitive. If the roofing contractor is a small company, the removal of the owner or key person on a current job site can be time prohibitive.

Another factor that may impact the roofing contractor's ability to provide a written estimate is weather and traffic.

Recently, solar panels have become popular. In order to install solar panels, the roof's slope, geometrical shape, and size as well as its orientation with respect to the sun all must be determined in order to provide an estimate of the number and type of solar panels required.

SUMMARY

These and other objects are met by the system and method disclosed herein that allows a customer that needs the sizes, dimensions, slopes and orientations of the roof sections of a building roof in order to provide a written report that provides and graphically shows this information estimate. A roof estimation system that practices at least some of the techniques described herein may include an image acquisition engine, a roof modeling engine, and a report generation engine. The roof estimation system is configured to generate a model of a roof of a building, based on one or more aerial images. In addition, the roof estimation system is configured to generate a roof estimate report based on the generated model.

In some embodiments, the roof estimation system includes a user interface engine which provides access to at least some of the functions of the roof estimation system. In one embodiment, the user interface engine provides interactive user interface components operable by an operator to perform various functions related to generating a model of a roof of a building, including image registration, lean correction, pitch determination, feature identification, and model review and/or correction.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a roof estimation system screen display illustrating a new roof estimation project.

Figure 2 is a roof estimation system screen display illustrating reference plane determination for an image providing a top-down view of a building.

Figure 3 is a roof estimation system screen display illustrating image registration for an image providing a top-down view of a building.

Figure 4 is a roof estimation system screen display illustrating reference plane determination for an image providing a south view of a building.

Figure 5 is a roof estimation system screen display illustrating image registration for an image providing a south view of a building.

Figure 6 is a roof estimation system screen display illustrating reference plane determination for an image providing a north view of a building.

Figure 7 is a roof estimation system screen display illustrating image registration for an image providing a north view of a building.

Figure 8 is a roof estimation system screen display illustrating reference plane determination for an image providing a west view of a building.

Figure 9 is a roof estimation system screen display illustrating image registration for an image providing a west view of a building.

Figure 10 is a roof estimation system screen display illustrating reference plane determination for an image providing an east view of a building.

Figure 11 is a roof estimation system screen display illustrating image registration for an image providing an east view of a building.

Figure 12 is roof estimation system screen display illustrating an example registration for multiple images of a building.

Figure 13 is roof estimation system screen display illustrating roof model generation based on multiple images of a building.

Figure 14 is a roof estimation system screen display illustrating pitch determination in an image providing a west view of a building.

Figure 15 is a roof estimation system screen display illustrating pitch determination in an image providing an east view of a building.

Figure 16 is a roof estimation system screen display illustrating wire frame model construction in an image providing a top-down view of a building.

Figure 17 is a roof estimation system screen display illustrating wire frame model construction in an image providing an east view of a building.

Figure 18 is a roof estimation system screen display illustrating a first view of a roof model constructed using multiple images of a building.

Figure 19 is a roof estimation system screen display illustrating a second view of a roof model constructed using multiple images of a building.

Figure 20 is a roof estimation system screen display illustrating a view of a roof model annotated with pitch values.

Figure 21 is a roof estimation system screen display illustrating a view of a roof model annotated with pitch values.

Figure 22 is a roof estimation system screen display illustrating a pitch determination tool in a first position.

Figure 23 is a roof estimation system screen display illustrating a pitch determination tool in a second position.

DETAILED DESCRIPTION

Embodiments described herein provide enhanced computer- and network-based methods, techniques, and systems for estimating construction projects based on one or more images of a structure. Example embodiments provide a roof estimation system that is operable to provide a roof estimate report for a specified building, based on one or more aerial images of the building. In one embodiment, a customer of the roof estimation system specifies the building by

providing an address of the building. The roof estimation system then obtains one or more aerial images showing at least portions of the roof of the building. Next, the roof estimation system generates a model of the roof of the building, which is utilized to generate a roof estimate report. The roof estimate report includes one or more line drawings of the roof of the building, which are annotated with information about the roof, such as lengths of the edges of sections of the roof, pitches of sections of the roof, areas of sections of the roof, etc.

Embodiments of the roof estimation system include a user interface configured to provide access to one or more of the functions of the roof estimation system. In one embodiment, the roof estimation system includes user interface controls that facilitate image registration (described with reference to Figures 2-12), roof model generation (described with respect to Figures 13-19), pitch determination (described with reference to Figures 14-20, and 22-23), and roof model review (described with reference to Figure 21).

Figure 1 is a roof estimation system screen display illustrating a new roof estimation project. In particular, Figure 1 shows an example graphical user interface to a roof estimation system. In the illustrated embodiment, the user interface is utilized by an operator to generate a three dimensional model of a roof of a building. Figure 1 shows the user interface in an initial state, after an address of a building has been specified and images of the building have been obtained and loaded into the roof estimation system. The user interface shows five images of the building, each image showing a different view. In particular, the five images show a top-down, east, west, north, and south view of the building. The left-hand side of the screen includes a control panel that includes controls for setting the reference plane for the images, setting the vertical (Z) axis for the images, switching between different images, saving the model, etc. Each image includes four marker controls that appear as "cross hairs" on the corresponding image. The marker controls may be used by the operator to set reference points in the image

for purposes of image registration, as will be described with reference to Figures 2-13, below.

Figures 2-13 illustrate the process of image registration. Image registration includes specifying a reference plane for each of the images, such that each image may be aligned to a single plane within a three-dimensional ("3D") grid that is shared between all of the images. Typically, an operator specifies a reference plane by, for each image, utilizing marker controls to identify points having equal or substantially equal elevations on the roof. Each of the identified points in an image corresponds to an identified point in each of the other images. For example, in a roof having four corners, an operator may, for example, mark each of the four corners of the roof in each image of the roof. Based on these identified points, the roof estimation system determines a translation between each image and the reference plane.

Figure 2 is a roof estimation system screen display illustrating reference plane determination for an image providing a top-down view of a building. In Figure 2, the operator has moved one marker control onto a distinct corner of the roof of the building. Note that the marker controls have been rotated (compared to those shown in Figure 1) by the operator, so as to specify the X and Y axes of the reference plane.

Figure 3 is a roof estimation system screen display illustrating image registration for an image providing a top-down view of a building. The illustrated screen display provides the operator with feedback to determine whether the reference plane was accurately set. The feedback is provided via crosshairs (registration indicators) that indicate registration errors, such as the difference between the axes of the reference plane and the image.

Figures 4 and 5 illustrate the process of image registration with respect to a south view of the building. In these figures, the operator has moved marker controls to each of the four roof corners specified as described in Figures 2 and 3, above. The marker controls are color coded, such that the operator can set

each marker control to the roof corner marked with the same control in a previous view.

Figure 4 also illustrates a lean correction control that facilitates the correction of the vertical (Z) axis. In this embodiment, the lean correction control is part of one of the marker controls and appears as a substantially vertical line having an open circle at the end. The operator may manipulate this line in order to adjust the vertical axis.

Figures 6 and 7 illustrate the process of image registration with respect to a north view of the building. In these figures, the operator has moved marker controls to each of the four roof corners specified as described in Figures 2-5, above.

Figures 8 and 9 illustrate the process of image registration with respect to a west view of the building. In these figures, the operator has moved marker controls to each of the four roof corners specified as described in Figures 2-7, above.

Figures 10 and 11 illustrate the process of image registration with respect to a west view of the building. In these figures, the operator has moved marker controls to each of the four roof corners specified as described in Figures 2-9, above.

Although the operator is shown registering a total of five images in the illustrated example, in other cases, fewer images may be used.

Figure 12 is roof estimation system screen display illustrating an example registration for multiple images of a building. In particular, Figure 12 illustrates multiple views of the building after the image registration process of Figures 2-11 has been completed. The operator may review these images, and the registration feedback crosshairs placed thereupon, in order to determine whether the images have been registered with a sufficient degree of accuracy to proceed to roof model generation, as described next.

Figures 13-21 generally illustrate aspects of the process of roof model generation based on multiple registered images. In particular, these figures illustrate the construction of a roof model by an operator. Model generation/construction may include identification of roof features shown in various images of the roof, such as edges, planar sections, vertexes, and the like, as well as determination of roof pitch and other dimensional attributes of the roof. Each identified roof feature is incorporated by the roof estimation system into a 3D model of the roof, based on a translation between an image in which the feature is identified and the reference grid, as determined by the process described with reference to Figures 2-12, above.

Figure 13 is roof estimation system screen display illustrating roof model generation based on multiple images of a building. In particular, Figure 13 illustrates the roof estimation system user interface after the operator has completed image registration, but before the operator has begun roof model construction.

Figure 14 is a roof estimation system screen display illustrating pitch determination in an image providing a west view of a building. In Figure 14, the operator utilizes a pitch determination control to specify the pitch of one of the planar roof sections. The pitch determination control appears as a dashed line emanating from the center of the crosshairs placed upon the large image. The dashed line may be manipulated by the operator in order to line it up with the sloped edge of the roof.

Figure 15 is a roof estimation system screen display illustrating pitch determination in an image providing an east view of a building. In this figure, the operator determines the pitch of the same roof section described with reference to Figure 14, but from a different view.

Figure 16 is a roof estimation system screen display illustrating wire frame model construction in an image providing a top-down view of a building. In wire frame model construction, the operator typically draws or traces planar roof

sections shown in each of the images of the building. The roof estimation system then adds each planar roof section to the 3D roof model, based on the translation between the image and the reference plane determined as described above.

As the operator draws a planar roof section onto one image, the roof estimation system concurrently projects the planar roof section into each of the other images, so that the operator receives feedback regarding the accuracy of the location and/or dimensions of the roof section. Generally, the roof estimation system can be configured to concurrently display any operator-identified features, such as corners, ridges, valleys, planar sections, and the like, in multiple views of a building.

Figure 17 is a roof estimation system screen display illustrating wire frame model construction in an image providing an east view of a building. Here, the operator has switched to a different view to determine the accuracy of the constructed wire frame model, and/or to further modify or add to the wire frame model constructed as described above.

Figures 18 and 19 illustrate two views of the roof model constructed as described above. In particular, Figure 18 is a roof estimation system screen display illustrating a first view of a roof model constructed using multiple images of a building. The roof model is shown as a shaded wire frame graphic displayed near the center of the screen. Figure 19 is a roof estimation system screen display illustrating a second view of a roof model constructed using multiple images of a building. The roof model is shown as a shaded wire frame graphic displayed near the lower right of the screen.

Figure 20 is a roof estimation system screen display illustrating a view of a roof model annotated with pitch values. In Figure 20, the wire frame model described above is shown superimposed upon the top-down view of the building. The model has been annotated with pitch indicators. The illustrated pitches are determined based on the operator's utilization of the pitch tool

described with respect to Figures 14-15, above, and the operator's specification of the wire frame roof model described with respect to Figures 16-19, above.

Figure 21 is a roof estimation system screen display illustrating a view of a roof model annotated with pitch values. In particular, Figure 21 illustrates a top-down plan view, as a line drawing, of the roof model generated as described above. The line drawing is annotated with dimensions of the edges of the planar roof sections that make up the roof. The line drawing is interactive, in that the operator may adjust it in order to make corrections or other adjustments to the layout and/or dimensions.

Figures 22 and 23 show a pitch determination tool that may be used in addition to, or instead of, the pitch determination tool described with respect to Figures 14 and 15, above. In particular, Figure 22 is a roof estimation system screen display illustrating a pitch determination tool in a first position. The pitch determination tool (an "envelope" tool) is shown near the center top of the screen. The pitch determination tool is interactive, in that it may be moved to a position on the roof, and adjusted to visually envelope two adjoining roof sections in order to determine the pitch of the enveloped roof sections.

Figure 23 is a roof estimation system screen display illustrating a pitch determination tool in a second position. In this example, the operator has moved the pitch determination tool over the roof of the house, and adjusted the angle of the "envelope" so that it appears to lie atop two sections of the roof. Then, the roof estimation system determines the pitch of the roof sections, based on the configuration of the envelope with respect to the image and the reference plane.

The following section provides additional details regarding one example embodiment of a roof estimation system user interface. In particular, it describes various aspects of model construction based on multiple images, including reference plane determination, image registration, lean correction, model construction, pitch determination, and model review.

Process Steps

Now that you've checked your images, you're ready to begin working on the project.

As you already learned, there are five basic sections in **Render House** that are listed on the left side of the screen in the **Control Panel** (shown in the next image).

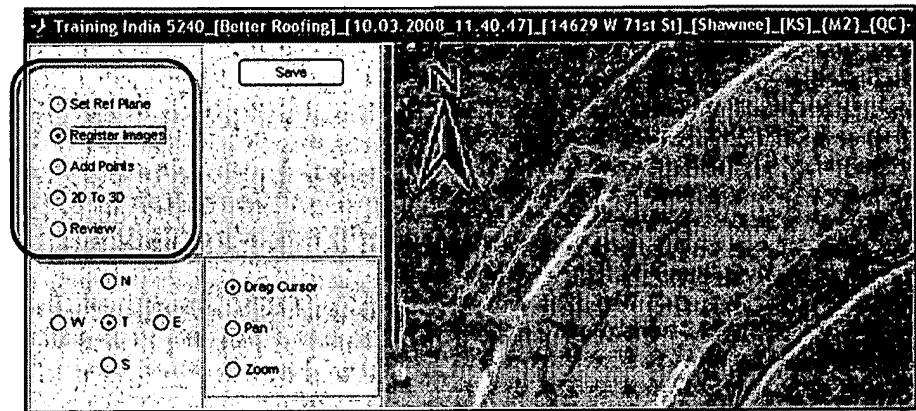


Figure 1 Render House – Five Steps

The following is a list of these five steps with a short description of each. You'll go through each step as you work on a roof in **Render House**.

- **Set Ref Plane** – The first thing you will do is set the **Reference Plane**. This tool is used to share information across five different images of a roof, all from different angles, to align them all to the same **3D Grid** before beginning to measure the roof. In other words it is used to set a **Reference Plane**. Four points of equal or similar elevation are identified across the length of the roof.
 - An **Origin Marker** determines the horizontal angles of the roof and the **Vertical Lean** of the **Top** view. This is also the point which will be used to begin measuring the roof.
 - Three colored points are set across the roof to determine the **3D Grid**.
- **Register Images** – This second step is closely related to **Set Ref Plane**. It is a tool used to ensure the **Reference Plane** was set properly and each of the 5 views is accurately aligned to the **3D Grid**.
- **Add Points** – This third step and tool is used to measure the roof. Points are added and connected to create the various pieces of a roof in their angles and positions.
 - The **Origin Point** must be used as the first point on the roof.
 - Larger and easier parts of a roof should be built first, followed by smaller more complicated pieces.
 - Pitch will need to be determined and tested before building the roof.
 - **Add Points** also includes a viewable **3D Model** of the roof in progress.
- **2D to 3D** – This step shows the pitches of the roof and allows for some minor adjustments to be made to existing points.
- **Review** – This final step generates an outline of the measurements and allows for the labeling of **Ridges** and **Valleys**. The customer will see this in their report.

Set Reference Plane

After locating the project in **Render House** and clicking New, In-Progress or Rework, the main Eagle View Measurements software package appears. The first step in the measurement stage is to set the **Reference Plane**.

Setting the Reference Plane

The first thing you will do when starting to work on a roof is to set the **Top** view **Reference Plane**. To do this:

1. To begin, make sure that the **Set Ref Plane** and **Top** view options are selected.

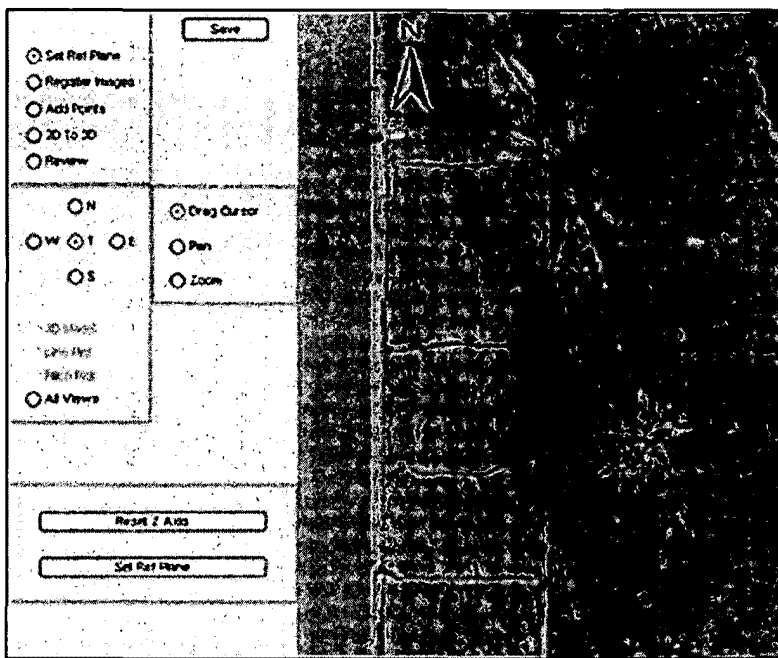


Figure 2 Render House - Steps and Views

2. Set the **Origin Marker**.

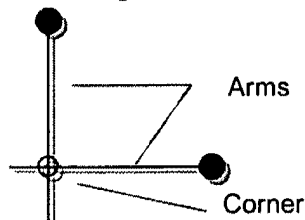
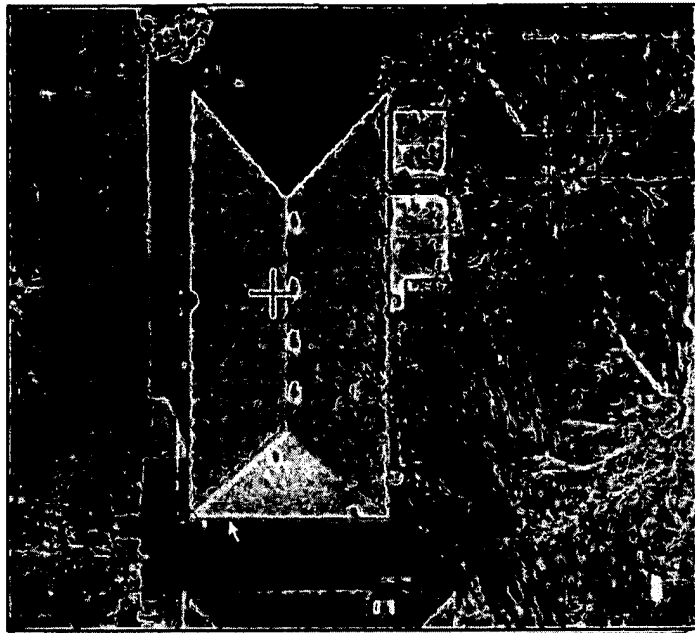


Figure 3 Render House – Origin Marker

To do this, use your mouse to drag and align the arms of the **Origin Marker** with the edges of the roof. Be sure to place the corner of the **Origin Marker** on a good starting point.

Notes

**Figure 4 Placing the Origin Marker**

The starting point is usually:

- a. On a corner of the **Drip Edge** of the roof
 - b. Or on a large or sizeable portion of the roof
 - c. Or on a large roof, it may be somewhere near the center
3. Set the **Reference Points** around the roof dragging each cross to a clear point of similar elevation.



Note: They should be placed at equal or similar elevation and span the length of the roof (don't cluster them close together).

Notes

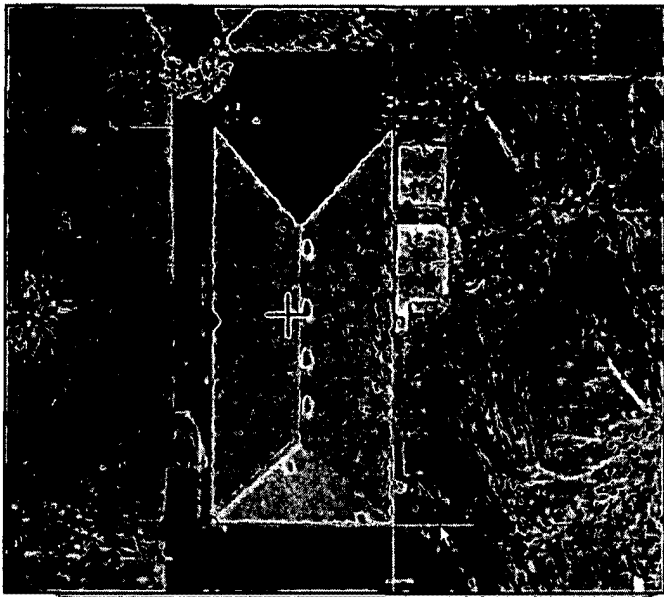


Figure 5 Placing the Reference Points

4. Set the Z-axis for the **Top-down** view.
 - d. **Render House** attempts to set the Z-axis automatically, but much of the time it is not set correctly.
 - e. To test whether or not the Z-axis is set correctly, follow these steps.
 - i. Click **Set Ref Plane**.
 - ii. Click **Save**.
 - iii. Select **Register Images**.

Note: The **Top** view may not always be exactly straight down on the roof. This occurs when the roof is not directly below the camera when the photo is taken. When an airplane flies over an area taking pictures, the photographs encompass a wide area, so homes to the left and right of the airplane will have some degree of offset. This is called **Lean**.

- iv. In **Top** view and check that the **light blue crosshair line** is pointing in the same direction as the Z-axis was pointing in **Set Ref Plane**. If it is not correct, click **Invert Tilt**.

Notes

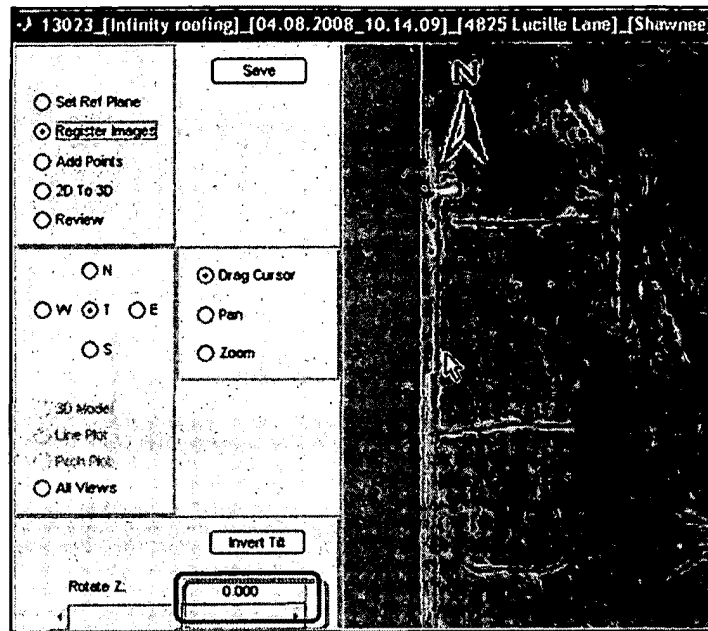


Figure 6 Invert Tilt button

v. Select **Add Points**.

Find a section of the roof with two sloping sides that are both the same length.

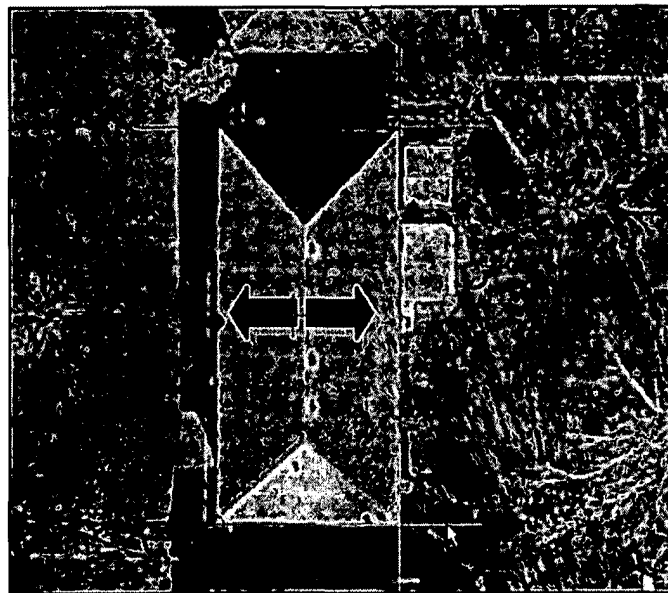


Figure 7 Facets of equal slope

Notes

- vi. Measure both sides. To do this,
 - 1. Move the **Cursor** to the **drip edge** of one of the sides.
 - 2. Turn your **pitch** on going up the **slope**. Try to estimate the **pitch**.
Note: steeper is better than shallower.
 - 3. Create a **point**
 - 4. Move up the **slope** to the **ridge**.
 - 5. Check the length of the **segment** from **drip edge** to **ridge** (this is called the **rafter length**).
The length of the current line **segment** can be seen on the left side of the screen in the box next to the corresponding axis.
 - 6. Without moving the mouse pointer, delete the **point** at the **drip edge**.
 - 7. Turn **slope** on going down the other side.
 - 8. Create a **point** on the upper **ridge**.
 - 9. Move the **Cursor** to the **drip edge**.
 - 10. Check the length of **segment** from **ridge** to **drip edge** (this is also called the **rafter length**).
- vii. Both sides should be the same length.
- viii. Repeat process for two symmetrical **regions** oriented perpendicular to the first **regions** measured. (i.e., the z axis needs to be tested along both the x and y axis)

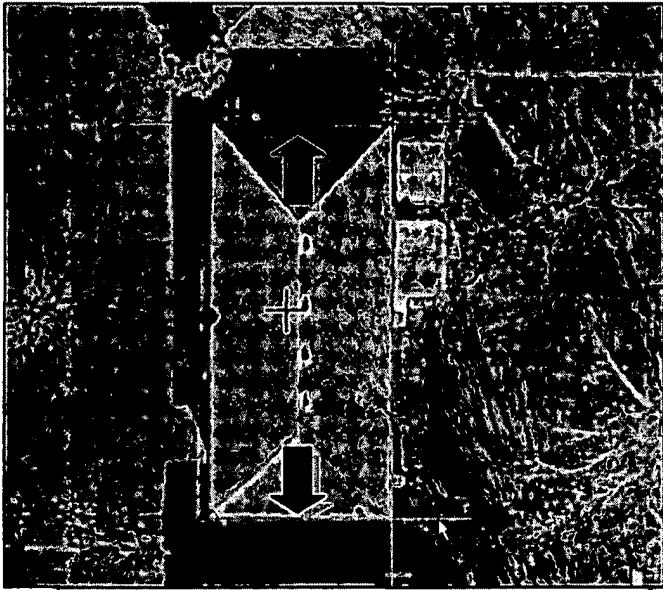


Figure 8 Perpendicular facets of equal slope

- f. If set correctly, continue building the roof.
- g. If set incorrectly fix it. To do this,
 - i. Select **Set Ref Plane**
 - ii. Set the Z-axis to 0 (place the blue circle directly over the cross point of the x and y axis.
 - iii. Click **Set Ref Plane**.

Notes

- iv. Select **Register Images**.
 - v. Select **Add Points**.
 - vi. Measure both sides of the slope which previously measured incorrectly.
Usually one side will look slightly bigger because of the angle of the image.
 - vii. The Z-axis will eventually need to lean toward the side of the slope which measures shorter when the Z-axis is set to 0.
 - viii. Select **Set Ref Plane**.
 - ix. Move the Z-axis toward the sides of the roof which previously measured shorter.
Tip: Chimneys can be a good guide for getting the proper angle of the Z-axis, but they don't help much in determining how long it should be.
 - x. Click **Set Ref Plane**.
 - xi. Select **Register Images**.
Note: Double check the direction of the Z-axis and click **Invert Tilt**, if necessary.
 - xii. Select **Add Points**.
 - xiii. Measure the distances again and continue making adjustments as necessary.
5. Select **Set Ref Plane**.
 6. Select the **North** view.



Figure 9 North view in Control Panel

7. Place the **Origin Marker** on the same point of the roof used in the **Top** view.
8. Align the arms of the **Origin Marker** so that they are pointing in roughly the same direction they are pointing in the **Top** view in regard to the frame, not the roof.
9. Set the Z-axis for a side view.
 - h. Setting the Z-axis in the side angle views is much easier, but is essentially accomplishing the same thing.
 - i. The Z-axis in the **Top** view represents a set length from end to end. The exact positioning is, therefore, very important in properly assigning the angle at which the image was captured.
 - j. In the side views, the length does not matter. The Z-axis is simply an indicator of what direction is straight up from the ground.
 - k. The edge of a chimney or the corner formed by two walls of a roof can be used to determine the proper angle. Anything that represents a line traveling directly upwards from the ground at a right angle is acceptable.
 - l. The length of the Z-axis in the side views does not matter but it is generally better to pull the Z-axis out to roughly the same length as the arms of the **Origin Marker**. This will reduce errors because small adjustments are not as severe with a longer Z-axis.
10. Place the **Reference Points** around the roof in the same locations as were used in the **Top** view.
11. Click **Set Ref Plane**.
12. Click **Register Images**.

Note: Make sure everything is registering properly. If not, make adjustments (see section, **Adjusting the Reference Plane**)
13. Repeat the steps of the **North** view to set the **Reference Plane** in each of the remaining views.

The following are some tips that may be of use in setting the **Reference Plane**.

- It's a good idea to **Save** frequently to ensure all work is retained.
- Try to place the **Reference Points** in locations you can see in all views of the roof.

Note: Using three or more points, make sure that the elevation is similar at each point. Also note that the **Reference Plane** can be refined after adding points, but this is an advanced feature.

Notes

Adjusting the Reference Plane

As you perform your job, you will get more proficient at setting **Reference Planes**. But, no matter how skilled you get, you will still need to make adjustments to the **Reference Plane** at times.

Here are the steps you should follow when this is necessary.

1. After setting the **Reference Plane** and Z-axis, click on **Register Images**.
2. In each of the side views there should be a **vertical light blue line** pointing upward directly through the center of a set of **green crosshairs** where each of the **Reference Points** were placed.
3. In the spot where the **Origin Marker** was placed there should be two **Magenta Lines** representing both of the red lines of the **Origin Marker** and a **light blue line** sticking straight up representing the Z-axis which was set. Two additional **light blue lines** should be exactly underneath, or very close to, the **magenta lines**. These **light blue lines** are slightly longer than the **magenta lines** so they will stick out at the end if they are exactly underneath.
4. When something seems wrong (isn't as described above), check for the following scenarios.
 - m. **Horizontal light blue lines don't align with magenta lines...**
 - i. This is commonly an issue with the Z-axis.
 - The three **light blue lines** extending from the **Origin Marker** form the corner of a cube. If the vertical line (Z-axis in **Set Ref Plane**) is pushed or pulled in one direction, the horizontal lines of the cube will also move accordingly.
 - Return to **Set Ref Plane** in order to adjust the Z-axis.
 - Move the Z-axis to push or pull the **light blue lines** until they are even with the **magenta lines**.
 - Click **Set Ref Plane**.
 - Return to **Register Images** to check if the problem has been fixed.
 - ii. This is frequently an issue with the angle of the X or Y axis...
 - Return to **Set Ref Plane** in order to adjust the X or Y axis.
 - Double-check that the **Origin Marker arms** are aligned properly with the edges of the roof. Move the **Origin Marker** to several spots on the roof to make sure the lines are properly angled and place the **Origin Marker** back in the original spot.
 - Click **Set Ref Plane**.
 - Return to **Register Images** to check if the problem has been fixed.
 - iii. **Ref Points or Origin Marker** could be placed wrong on the roof.
 - Double-check that all of the **Reference Points** are on the same location of the roof in all of the views. This can often be confusing, so verify it.
 - n. **Vertical blue lines do not intersect green crosshairs.**
 - This is probably an issue with placement of **Reference Points** or the **Origin Marker** in relation to the **Top** view.
 - Verify that all **Reference Points** and the **Origin Marker** are properly placed.

Add Points

The application supports the following interactive features.

- **Zoom** - Allows users to zoom In and Out on a point, line, or region;
- **Pan** - Allows users to move pictures horizontally and vertically across the screen;
- **3D Model** - Shows plotted sketch in 3D, rotating view.

Steps to Set the Pitch

To add points, first set the pitch.

- **Common Pitch Values**—The most common **Pitch Values** are even numbers between 4 and 12 including 9. This is not always the case, however, just the norm. Any **Pitch** can occur, but always be sure before spending time building a roof with the wrong **Pitch**. A good rule of thumb is if a roof can be built with an even **Pitch**, do it.
- **Gabled Roofs**—
 1. In a side view with a clear and direct view of the **Gable**, move the **Cursor** to the peak of the **Gable**.
 2. Turn on the **Pitch** moving down one side of the **Gable**. Adjust until the dotted **Pitch** line matches the **Slope** of the **Gabled** roof.
 3. Turn the **Pitch** toward the opposite side of the **Gable** to double-check on the other side of the **Gable**.
 4. Keep in mind a bad **Reference Plane** can cause this process to incorrectly determine the **Pitch**. Be sure your **Reference Planes** are accurate!
- **Hipped Roofs**—
 1. **DO NOT** match your dotted **Pitch** line to the angle of the **Ridge** line which travels from the base to the peak of the **Hip**.
This WILL NOT WORK!
 2. Navigate the **Cursor** to the **Drip Edge** on the corner of a **Hip**.
 3. Looking at the **Top** view move the **Cursor** along the **Drip Edge** of the roof until the perpendicular axis is aligned with the peak of the **Hip**.
 4. Switch to a clear side view which approaches the **Hip** and **Cursor** side by side as opposed to one in front of the other.
 5. Turn on the **Pitch** going up the **Slope** and adjust the value until the dotted **Pitch** line meets the peak of the **Hip**.
 6. Return to the **Top** view to assure the dotted **Pitch** line is still lined up with the peak of the **Hip**. If it is not, move the **Cursor** until it is.
 7. Continue making adjustments as necessary until the line is even with the peak of the **Hip** in both the **Top** view and the side views.
 8. Trace the **Region** against which the **Pitch** was set and make sure it is set correctly. Make adjustments as necessary.
- **Multiple Pitches**
 1. Many roofs have multiple **Pitches** around the roof. Most commonly, a roof will have a more shallow **Pitch** on the front and back and a steeper **Pitch** on the sides. In other words, the front and back might be a **Pitch** of 8 and the sides of the roof might be a 10.
 2. Many roofs have a more shallow **Pitch** on lower sections of roof which extend from walls.

Notes

3. Keep an eye out for anything, however, as there are always exceptions to the rule.

Building the Roof

1. Always begin building a roof with the **Origin Point** created by setting the **Reference Plane**.
2. With the **Pitch** set begin tracing a **Region** connected to the **Origin Point**.
3. Continue building **Regions** which are connected.
 - o Never build two **Regions** separately which will eventually be connected in the process of building the roof.
 - o Some roofs have sections of roof which do not connect. In this situation it would be okay to build two **Regions** which don't connect.
4. Always look at multiple images before drawing a **Region**. The image quality can often be confusing and the shape of a **Region** should be verified in several images before drawing the shape.

Tips:

- Complete the shape by press "y" on the controller.
- Begin another adjacent plane.
- Click on **3D model** often.
- Save often.
- Click the "A" button to use an existing point, or "B" to establish a new point.
- Start within a simple region. Once you complete with one region then try to connect the adjacent regions.
- Remember to re-use existing points whenever two planes are attached.

2D To 3D

The **2D To 3D** portion of the program is mainly used to verify pitch values for the various pieces of the roof.

Using 2D To 3D

You may do the following in this step.

- **Individual Points** can be dragged horizontally only.
 - Elevation cannot be adjusted by dragging Points.
 - Dragging Points in 2D to 3D does not follow the 6-inch incremental grid which Add Points uses. This can cause confusion and asymmetry.
- **Multiple Points** can be dragged horizontally by selecting the line Segments between them before dragging.
 - This can be used to make minor adjustments to Pitch on Dormers or individual pieces on occasion.
- **Line Segments** that vary slightly in Elevation can be leveled.
 - This should be used for VERY MINOR ADJUSTMENTS ONLY!
 - Right-click the line Segment to be leveled.
 - Level Up will level the line to the higher of the two Points on the Segment.
 - Level Down will level the line to the lower of the two Points.
- **2D to 3D** can be used to ensure straightness of lines as well.
 - Top view in **Add Points** is very often at a slight angle because of the angle at which the picture was taken.
 - 2D to 3D plots the lines from an angle exactly over the roof. This is useful to determine how straight lines are and that Overhangs were drawn properly. The 2D To 3D wireframe won't match the image well, and that's fine.

Although a **3D Diagram** is generated, it is not included in the report due to the limited benefit to the customer. However, they're very useful for us internally for reviewing the model.

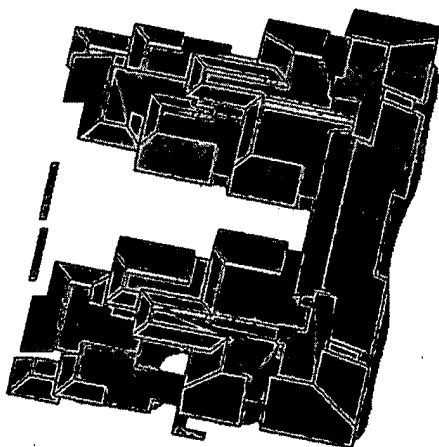


Figure 10 Render House – 3D Model of Roof

Notes

Review

Review has two main purposes. First, it allows you to label line segments by color. Second, it shows line length rounded to the nearest foot. This is especially useful for checking the symmetry of dormers, but is also useful to verify consistent line length.

Steps to Review

1. Select **Review**.
2. Review different values in the overview sketch.
3. Right click a line **segment** to label it. A dialog box appears and the proper label may be applied.
 - Red - ridge
 - Blue - valley
 - Yellow - hidden
 - Black - edge
4. **Render House** attempts to label the lines automatically and does a pretty good job, but it should never be completely trusted. There are ALMOST ALWAYS 1 or 2 errors.
5. Click **Save**.

Note: Hidden lines do not appear in the final report and are used to hide the segments connected to roof Dormers from an edge.

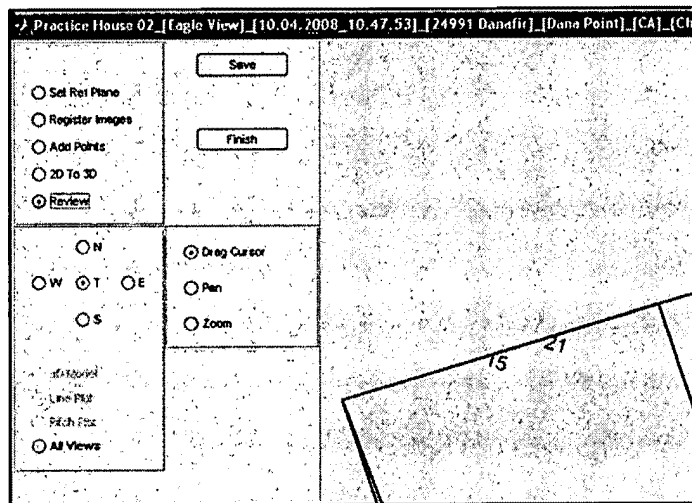


Figure 11 Render House – Review Step

Final Check

Naturally, the idea is that none of your projects are ever returned for rework. This wastes your time and costs Eagle View money.

To help you avoid rework, it's important to do a final check, before clicking **Finish** in Review, to ensure your project is accurate and correct the first time. Verify the following or there is no point in sending it to QC.

- **Check the Reference Planes.** If they don't match up in Register Images, the entire measurement could be wrong, even if it looks right.
- **Check for missing Regions.** Zoom out on all of the images to make sure no secondary buildings were missed. Check the 3D Model to make sure there are no holes left in the roof.
- **Check wire-frames.** If they appear too high over the upper Ridge lines they may be too steep. If they appear to be low, cutting into the roof, they could be Shallow. Wire-frames extending beyond or not reaching the Drip Edges of the roof could also indicate an incorrect Pitch Value.
- **Check the 3D Model.** Verify that there are no bending Regions or uneven drip edges.
- **Check 2D to 3D.** Ensure Pitch Values are consistent and correct. Adjustments will need to be made for incorrect Pitch Values.
- **In Review.** Verify the Segment labels and make corrections as necessary. Also, check symmetry and consistency of Segment Length.

If all looks correct, click **Finish** in **Review** to send the file to **Quality Control**. The project is now ready for **Quality Control** to perform a final check.

Advanced Training

Overhangs

Most houses have at least one area where a higher **Region** of the roof will extend slightly over a lower **Region**. This is referred to as an **Overhang**. The standard length of this overlap is 3 Clicks or 18 inches (the industry average).

Tracing around Dormers

Wall Dormers (even with **Edge** of roof)

- Go 18 inches beneath the **Dormer** on the **Drip Edge** and make a **Point**.
- Move the **Cursor** up the **Slope** of the roof until even with the **Point** at which the **Dormer** extends from the roof and make a **Point**.
- Move 18 inches to the **Point** at which the **Dormer** meets the roof and make a **Point**.
- Move up the roof to where the **Ridge** of the **Dormer** meets the roof and make a **Point**.
- Move down the other side of the **Dormer** and make a **Point**. Make both sides of the **Dormer** symmetrical.
- Move 18 inches underneath the **Dormer** and make a **Point**.
- Move down the **Slope** of the roof to the **Drip Edge** and make a **Point**.
- Continue tracing the rest of the **Region**.

Roof Dormers (protrude from a **Region** with roof completely surrounding the **Dormer**)

- On the **Drip Edge** of the **Region** from which the **Dormer** protrudes, move 18 inches inward past the **Edge** of the **Dormer** and make a **Point**.
- Move up the roof, under the **Edge** of the **Dormer** 18 inches and make a **Point**.
- Continue up the roof until even with the **Point** at which the **Dormer** extends from the roof and make a **Point**.
- Move 18 inches to the **Point** at which the **Dormer** meets the roof and make a **Point**.
- Move up the roof to where the **Ridge** of the **Dormer** meets the roof and make a **Point**.
- Move down the other side of the **Dormer** and make a **Point**. Make both sides of the **Dormer** symmetrical.
- Move 18 inches underneath the **Dormer** and make a **Point**.
- Move down the **Slope** of the roof until even with the first **Point** created 18 inches beneath the **Edge** of the **Dormer** and make a **Point**.
- Cut across to the other side of the **Dormer** and reuse the first **Point** under the **Overhang**.
 - A dialogue box will appear that says the **Point** is already a part of this **Region** and will ask you what you want to do.
 - Click **Add New Point**.
- Move down the **Slope** of the roof and reuse the **Point** on the **Drip Edge**.
 - A dialogue box will appear that says the **Point** is already a part of this **Region** and will ask you what you want to do.
 - Click **Add New Point**.
- Continue tracing the rest of the **Region**.

- When lining up **Points** on a **Slope** make sure to use the dotted **Pitch Line** and that said line is set at the proper **Pitch**.

Symmetry

Symmetry is not only an important part of measuring **Dormers**. Most **Regions** have some sort of aspect which is symmetrical in some way to itself or another **Region**.

When cutting around a **Dormer**, both of the angled sides will almost always be identical in length and distance from the peak.

When tracing the sides of a house, whether or not they are shaped exactly the same or whether or not they even touch, they will usually be the same distance from the upper **Ridge** to the **Drip Edge**. The length from **Edge** to **Ridge** is symmetrical.

Cursor Changes

Some houses have sections with horizontal lines changing direction. This is known as a **Cursor Change** because the orientation of the **Cursor** must be changed before that particular **Region** of the house can be drawn.

- It is usually a good idea to draw everything that can be drawn on the first section of the house before proceeding to the portion of the house which requires a **Cursor Change**.
- Navigate to the **Point** where the **Cursor Change** begins.
- Rotate the orientation of the **Cursor** using the keyboard.
 - Hold the control key and use the + or – keys on the keypad to rotate the **Cursor**.
- Once the **Cursor** is aligned with the next section of the house, continue building.

Consistent Edge Elevation

A good way to determine the elevation of a particular **Edge** is to follow the perimeter of the roof around the house from the **Origin Point**. This makes it easier to determine elevation changes around the house.

Where to Place the Origin Marker

When setting the **Reference Plane**, the first decision to make is where to place the **Origin Marker**. This will give you the **Origin Point**, which is the **first** Point used in mapping the roof.

The best place is usually a corner which is connected to two large shapes.

If it is a very large house, try to find a good **Point** on an **Edge** somewhere near the middle section of the house.

The key is placing the **Origin Point** somewhere that connects to two large shapes which span the majority of the length of the house.

Avoid setting the **Origin Point** on small, intricate, or unusual shapes.

Order in Which to Build the House

Always build from easy to difficult, and/or from large to small.

Notes

Using the bigger shapes that span large portions of the house is always the best way to start building a house. Follow in a logical order from easy, large shapes to smaller pieces like **Dormers**. Big pieces are easy to adjust if needs be. Save the small stuff for last because they are difficult to make adjustments to and will cause a lot of extra work if they are built early.

Traveling in Straight Lines

It is extremely important to travel in straight lines along one axis only, unless a diagonal **Ridge** or **Valley** between two shapes is being traced.

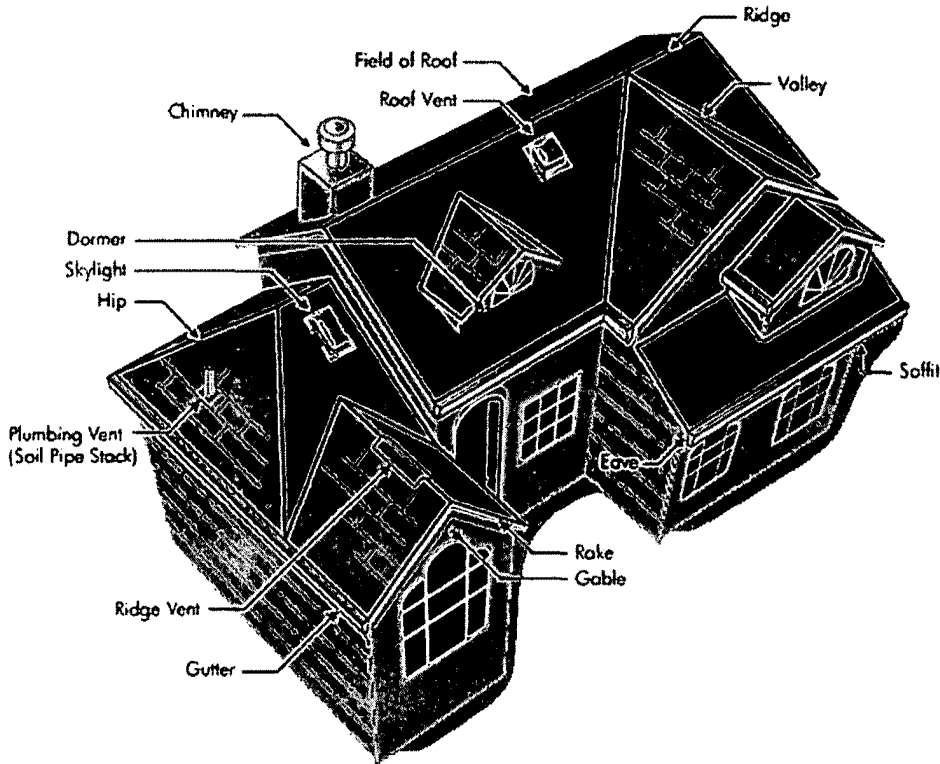
When traveling along the **Edge** of a house along the Red Axis, DO NOT move along the Green Axis at all, and vice versa.

If the **Cursor** does not properly line up with the **Edge** of the house or along a **Ridge** at the top of the roof, the **Reference Plane** needs to be adjusted and the **Origin Marker** properly aligned.

Appendix

Glossary of Terms

The following are terms you will need to know as you complete your training.

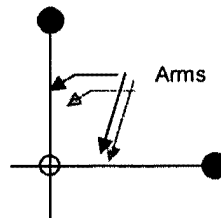


2D to 3D – The portion of **Render House** in which **Pitch** value can be verified along with a few minor adjustments.

3D Grid – The invisible **3D Grid** which is created by setting the **Reference Plane** in **Set Ref Plane**. This is commonly referred to as the **Reference Plane**.

Add Points – The portion of **Render House** in which points are added to create regions. In other words, this is where the roof is measured.

Arm – Each of two lines that comprise the **Origin Marker**.



Click – The segment of movement along the **3D Grid** in **Add Points**. Each click is 6 inches. "3 Clicks" is commonly used to refer to an 18" overhang.

Notes

Control Panel – The area on the left of the **Render House** user interface that contains the application controls.

Cursor – The red, green, and blue axes in **Add Points** which are used to add points to the **3D Grid**.

Cursor Change – A situation in which the **Cursor** must be manually rotated using the "Ctrl" and "+" or "-" keys on the keyboard to accommodate a change in the overall direction of a roof.

Dormer – Element of a roof that protrudes from the plane of a sloping roof to create space in the roof and enabling the addition of windows. (See **Roof Dormer** and **Wall Dormer**)

Dotted Pitch Line – The dotted line which extends from the **Cursor** and can be toggled on and off to use pitch when adding points.

Drag Points – Term used to describe the action of dragging points horizontally in the **2D to 3D** portion of **Render House**.

Drip Edge – Sometimes referred to as the lower edge, it is an edge at the bottom of a slope along which rain water would drip off. **Gutters** are usually only installed on **Drip Edges**.

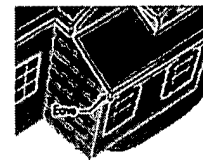
Eagle View Technologies – Our company that developed **Render House**.



East View – The side view looking West toward the East side of the roof.

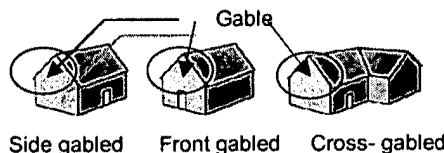
Edge – A label applied to a **Segment** in **Review** to imply it is the edge of the roof as opposed to a **Ridge** or **Valley**.

Eaves – An eave is the edge of a roof projecting beyond the side of the building. Most eaves and overhangs are about 18" wide (not including a gutter).



Elevation – A specific height in regard to a section of roof.

Gable – A gable is the triangle formed by two sides of a sloping roof.



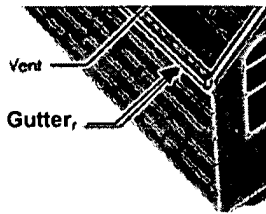
Green Cross Hairs – The green "+" symbols which appear in place of the Reference Points after switching from **Add Points** to **Register Images**.

Green Axis – X-axis.

Green Pitch – The Pitch along the Green Axis.

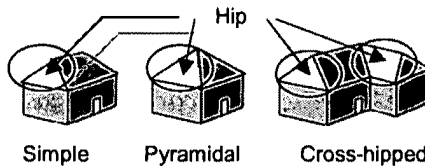
Notes

Gutter – A channel at the eaves or on the roof of a building, for carrying off rain water.



Hidden – A label applied to a **Segment** in **Review** to hide it in the final report delivered to the customer. Usually used to hide the line required to cut out a roof **Dormer**.

Hip – A gable with a third section of roof sloping downward and perpendicular from the peak.



Horizontal Light Blue Lines – The lines which are used to measure the accuracy of the **Reference Plane** in a particular view in **Register Images** by their relationship to the **Magenta Lines**.

In Progress – The folder in the **Queue Monitor** where files which are currently **In Progress** are kept.

Invert Tilt Button – The button in **Register Images** used to invert the angle of the **Lean** in the **Top** view. This is used to fix a common occurrence in which the **Lean** registers to the exact opposite of what it should be.

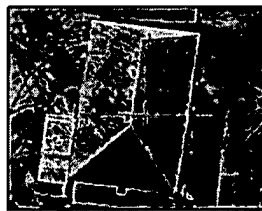
Lean – The angle at which the **Top** view image was captured.



Level Down – A tool used in **2D to 3D** to equalize the elevation of a segment to the lower of two points.

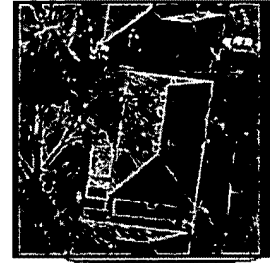
Level Up – A tool used in **2D to 3D** to equalize the elevation of a segment to the higher of two points.

Light Blue Crosshair Lines – The vertical **Light Blue Lines** at the center of the **Green Crosshairs** in **Register Images**. Used to determine the accuracy of the **Reference Plane**.



Notes

Light Blue Lines – A series of vertical and horizontal **Light Blue Lines** used in determining the accuracy of the **Reference Plane** in **Register Images**.



Lower Edge – See **Drip Edge**.

Magenta Lines – Horizontal **Magenta Lines** extending from the **Origin Point** in **Register Images** representing the relative position of the **Arms** of the **Origin Marker**. Used to determine the accuracy of the **Reference Plane** by their relationship to the **Horizontal Blue Lines**.



Missing Images – Of the five images used to measure a roof, one or more are occasionally missing.

Measurement Technician – The workers who measure roofs using **Render House**.

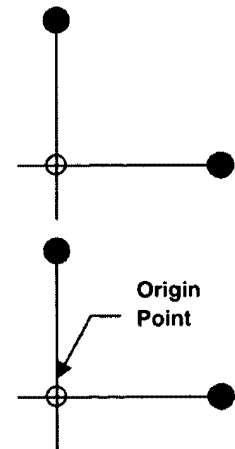
New – The folder in the **Queue Monitor** where files which are currently **In Progress** are kept.

North View – The Side view looking South toward the North side of the roof.

Open Region – A **Region** which has not yet been closed by using the Y-button on the controller.

Origin Marker – One of the tools used to set a **Reference Plane** in the **Set Ref Plane** portion of **Render House**.

Origin Point – The blue circle at the center of the **Origin Marker** that is used to mark the direction of **lean**.



Overhang – A lower section of roof which usually extends 3 Clicks (18 inches) under a higher section of roof.

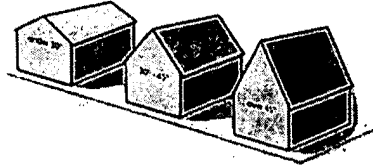
Peak Of Gable – The highest point along the edge of a **Gable** where two slopes meet.

Notes

Peak Of Hip – The highest point at which the three regions of a hip meet.

Perpendicular – Two lines, axes, directions, etc. which intersect at a right angle.

Pitch – The degree of steepness of a section of roof. Measured in feet as rise over run. Rise being the vertical distance traveled and run being the horizontal distance traveled along the slope of a roof. Run is always 12 feet. In roofing terms, the slope of a single section rising 6 feet over a run of 12 feet would be referred to as a 6/12. In Eagle View terminology the same slope would usually be referred to as a 6. Eagle View Measurement Technicians usually refer to multiple slopes on a single roof as 6/12 or 8/10 for example.

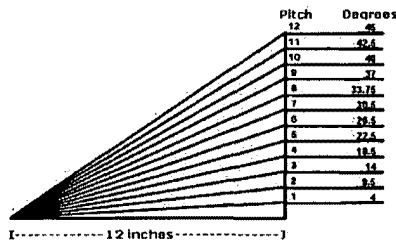


Pitch Value – The numeric representation of the pitch. See **Pitch**.

4/12 Pitch	5/12 Pitch	6/12 Pitch
------------	------------	------------



8/12 Pitch	9/12 Pitch	12/12 Pitch
------------	------------	-------------



Points – Points are created in **Add Points** to connect segments and form regions in order to measure a roof in **Render House**.

Poor Image Quality – The quality of images used in **Render House** varies greatly. These types of image may be blurry, distorted, dark, or washed out.

QC – See **Quality Control**.

Quality Control (QC) – The department of Eagle View which verifies the accuracy of the measurements taken by the **Measurement Technicians**.

Queue Monitor – The tool used for queuing files in the process of measuring roofs and delivering reports to customers.

Red Axis – Y-axis.

Red Pitch – The pitch along the red Axis.

Reference Plane – The 3D Grid established in the **Set Ref Plane** portion of **Render House**. It is set using the **Origin Marker** and **Reference Points** across five images.

Reference Points – Three colored crosshairs used in **Set Ref Plane** to establish the 3D Grid.

Region – A flat shape made up of various points. Roofs measured in **Render House** are comprised of many flat shapes pieced together.

Notes

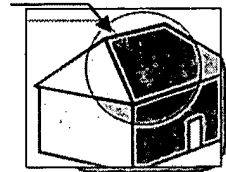
Register Images – The portion of **Render House** in which the accuracy of the **Reference Plane** is determined with the **green crosshairs**, **light blue lines**, and **magenta lines**.

Render House – An application developed by Eagle View Technologies used for measuring roofs using aerial images.

Review – The portion of **Render House** used to verify segment length and apply labels to individual **segments**.

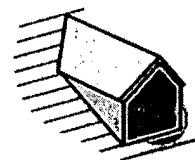
Rework – The folder in the **Queue Monitor** where files which did not pass **QC** and were sent back to the **Measurement Technicians** to be reworked are kept.

Ridge



Ridge – A label applied to a segment in **Review** to indicate it is a convex angle between two regions.

Right Angle – This is a 90-degree angle, or two lines that are exactly perpendicular to each other.



Roof Dormer – A dormer that protrudes from the center of a region with roof surrounding the dormer in all directions.

Segment – A line between two points. Typically this is a **ridge**, **valley** or **drip edge**.

Set Ref Plane – The portion of **Render House** in which information is shared amongst five images to create a common **3D Grid** or a **Reference Plane**.

Set Ref Plane Button – The button used to record the position of the **Origin Marker** and **Reference Points** to establish the **3D Grid** in the **Set Ref Plane** portion of **Render House**.

Shallow – A region with a low pitch value; usually four or less.

Shallow – A term usually used by the **QC** department to describe a measurement in which the pitch is set at a lesser value than it should be.

Side Views – North, East, South and West views.

Slope – A region to which a pitch value other than zero can be assigned is said to have slope.

Snap – The **left bumper** on the **controller** will instantly move the cursor to the nearest point which is highlighted with a green asterisk.

South View – The side view looking North toward the South side of the roof.

Starting Point – The pre-existing **Point** placed by the **Origin Marker** in **Set Ref Plane**.

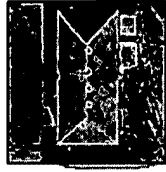
Steep – A region with a high **Pitch Value**; usually 12 or higher.

Notes

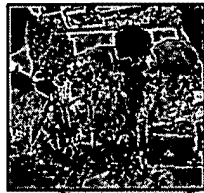
Steep – A term usually used by the QC department to describe a measurement in which the **pitch** is set at a greater value than it should be.

Symmetrical – Two sides of a **segment** which are the same. Most roofs have some symmetry and this should be considered when taking measurements.

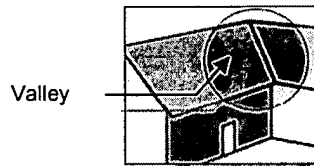
Top View – The image that is captured from directly above the roof. **Top** views are not always captured from directly above the roof. This causes distortion in the image (see **Lean**).



Tree Coverage – Many views are blocked by trees and are rendered useless. Many roofs cannot be measured because of tree coverage.



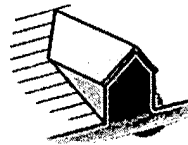
Valley – A label applied to a segment in review to indicate it is a concave angle between two regions.



Vertical Lean – See **Lean**

Vertical Light Blue Line – The light blue line in **Register Images** which represents the Z-axis.

Wall Dormer – A **dormer** which protrudes from a region closer to the lower edge and share a wall with the lower part of the roof. Roofing only surrounds the **dormer** above and to the sides.



West View – The side view looking East toward the West side of the roof.

X-axis – Green Axis.

Y-axis – Red Axis.

Z-axis – The blue line in **Set Ref Plane** which represents an axis which is perpendicular to both the **X-axis** and **Y-axis**. This axis is perpendicular to the ground.

From the foregoing it will be appreciated that, although specific embodiments have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the present disclosure. For example, the methods, systems, and techniques for generating and providing roof estimate reports discussed herein are applicable to other architectures other than the illustrated architecture or a particular roof estimation system implementation. Also, the methods and systems discussed herein are applicable to differing network protocols, communication media (optical, wireless, cable, etc.) and devices (such as wireless handsets, electronic organizers, personal digital assistants, portable email machines, game machines, pagers, navigation devices such as GPS receivers, etc.). Further, the methods and systems discussed herein may be utilized by and/or applied to other contexts or purposes, such as by or for solar panel installers, roof gutter installers, awning companies, HVAC contractors, general contractors, and/or insurance companies.

EXAMPLE CLAIM AREAS

1. A computer-implemented method for generating a roof estimate report, the method comprising:

displaying a first and a second aerial image of a building having a roof, each of the aerial images providing a different view of the roof of the building;

receiving an indication of a feature of the building shown in the first aerial image;

updating a three-dimensional model of the roof based on the received indication of the feature of the building;

concurrently displaying a projection of the feature in the first and second aerial images;

providing a roof estimate report based at least in part on the updated three-dimensional model.

2. The method of claim 1 wherein the indicated feature is at least one of: a section of the roof, a ridgeline of the roof, a valley of the roof, an edge of a section of the roof, and a corner of a section of the roof.

3. A computer-implemented method for generating a roof estimate report, the method comprising:

displaying an aerial image of a building having a roof;

providing a marker tool operable to specify a point on an image;

receiving, via the marker tool, an indication of a point on the aerial image;

registering, based on the received indication of the point, the aerial image to a reference plane; and

providing a roof estimate report based at least in part on the registered aerial image.

4. The method of claim 3 further comprising performing the method for multiple aerial images of the building, each of the multiple aerial images providing a different view of the roof of the building.

5. The method of claim 3 further comprising displaying a registration indicator that provides to an operator an indication of error in the registration of the aerial image to the reference plane.

6. A computer-implemented method for generating a roof estimate report, the method comprising:

displaying an aerial image of a building having a roof;

determining an approximate vertical axis based on metadata associated with the aerial image;

displaying the approximate vertical axis on the aerial image;

providing a user interface control operable to indicate a correction to the approximate vertical axis;

receiving, via the provided user interface control, a correction to the approximate vertical axis;

determining an updated vertical axis based on the received correction to the approximate vertical axis;

displaying the updated vertical axis on the aerial image; and

providing a roof estimate report based at least in part on the updated vertical axis.

7. A computer-implemented method for generating a roof estimate report, the method comprising:

displaying an aerial image of a building having a roof comprising a plurality of planar roof sections that each have a corresponding pitch;

providing a pitch determination control operable to indicate pitch of a planar roof section;

receiving, via the provided pitch determination control, an indication of the pitch of one of the plurality of planar roof sections of the roof of the building;

updating a three-dimensional model of the roof based on the received indication of the pitch of the one planar roof section; and

providing a roof estimate report based on the three-dimensional model of the roof.

8. The method of claim 7 wherein the pitch determination control is an adjustable protractor control.

9. The method of claim 7 wherein the pitch determination control is an envelope tool.

10. A computer-readable medium whose contents enable a computing system to generate a roof estimate report, by performing one or more of the methods of claims 1-9.

11. A computing system for generating a roof estimate report, the computing system comprising:

a memory;

a module that is stored on the memory and that is configured, when executed, to perform one or more of the methods of claim 1-9.

ABSTRACT OF THE DISCLOSURE

Methods and systems for roof estimation are described. Example embodiments include a roof estimation system, which generates and provides a roof estimate report based on one or more aerial images of a roof of a building. In some embodiment, a user interface provides access to one or more of the functions of the roof estimation system, including image registration, model generation, pitch determination, roof feature indication, lean correction, and/or document review.

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FIG. 1



FIG. 2



FIG. 3



FIG. 4



FIG. 5

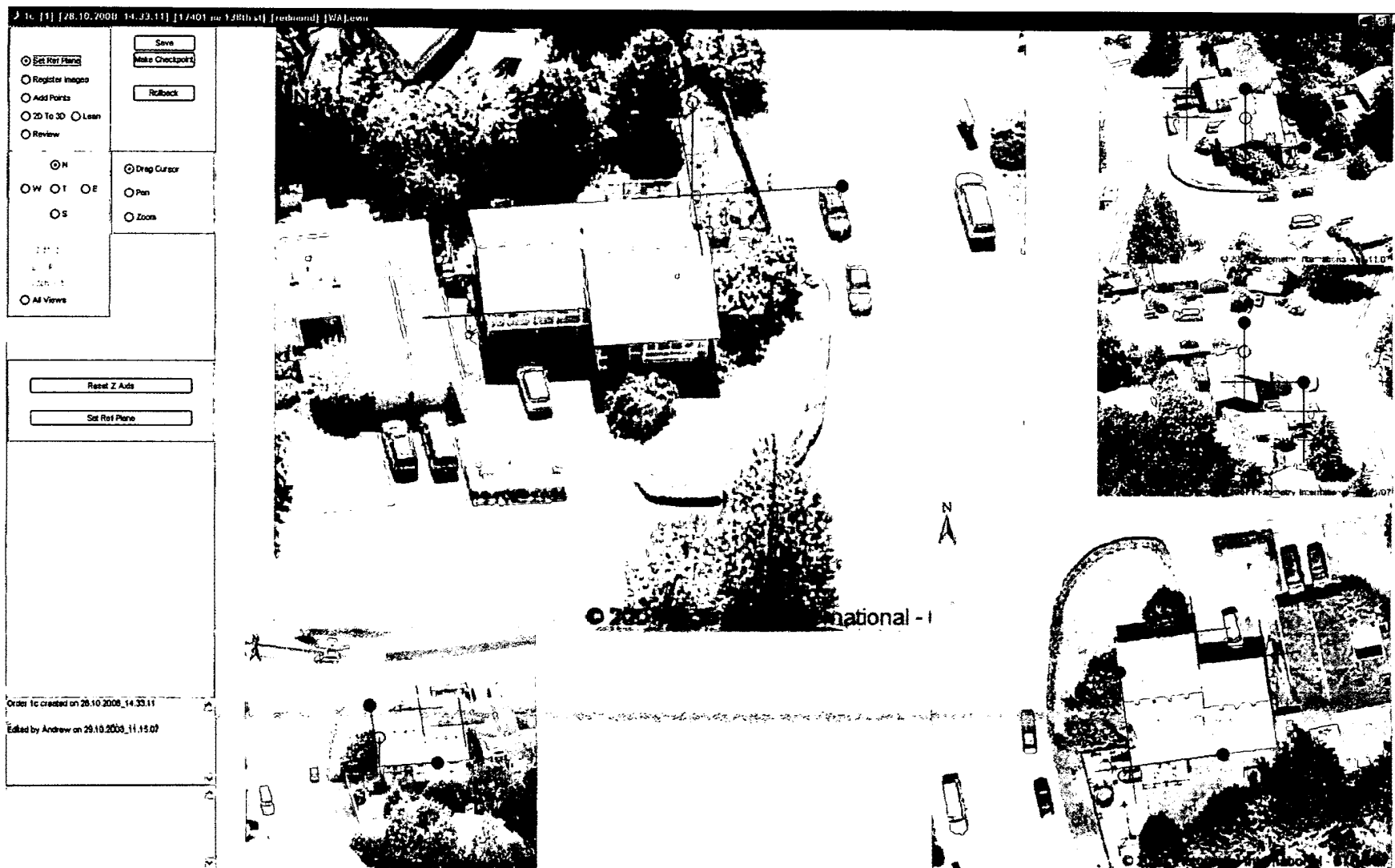


FIG. 6



FIG. 7

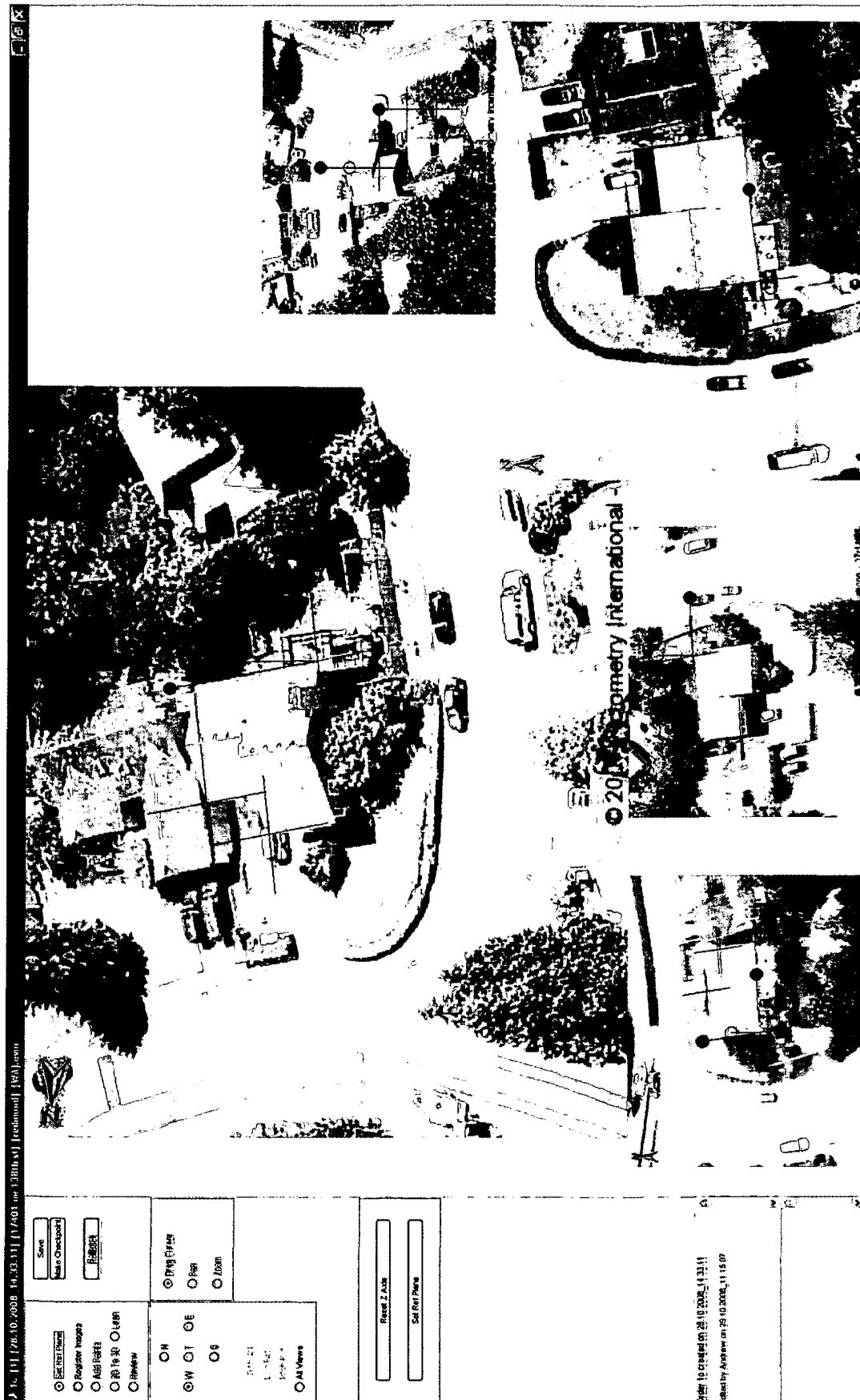


FIG. 8

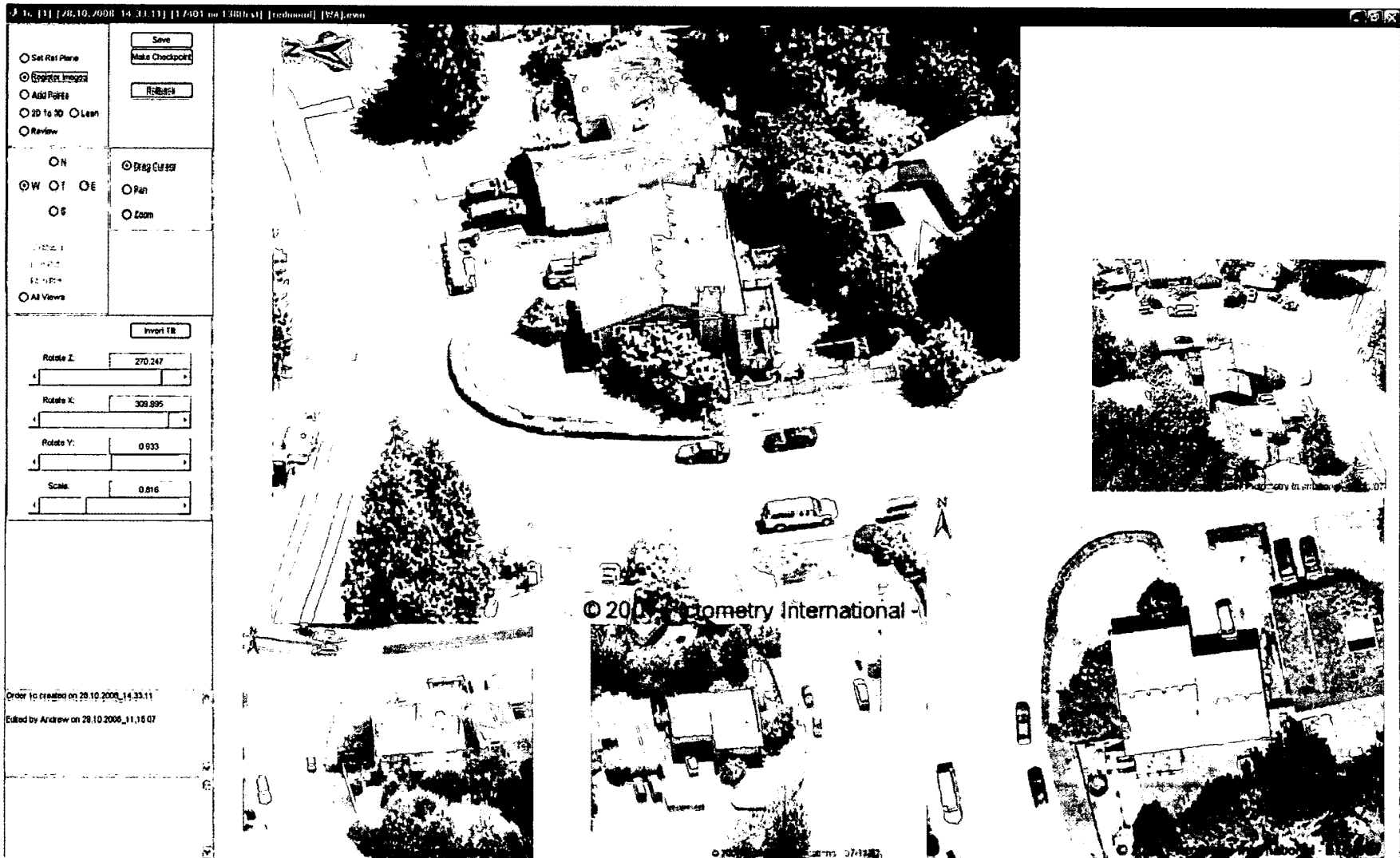
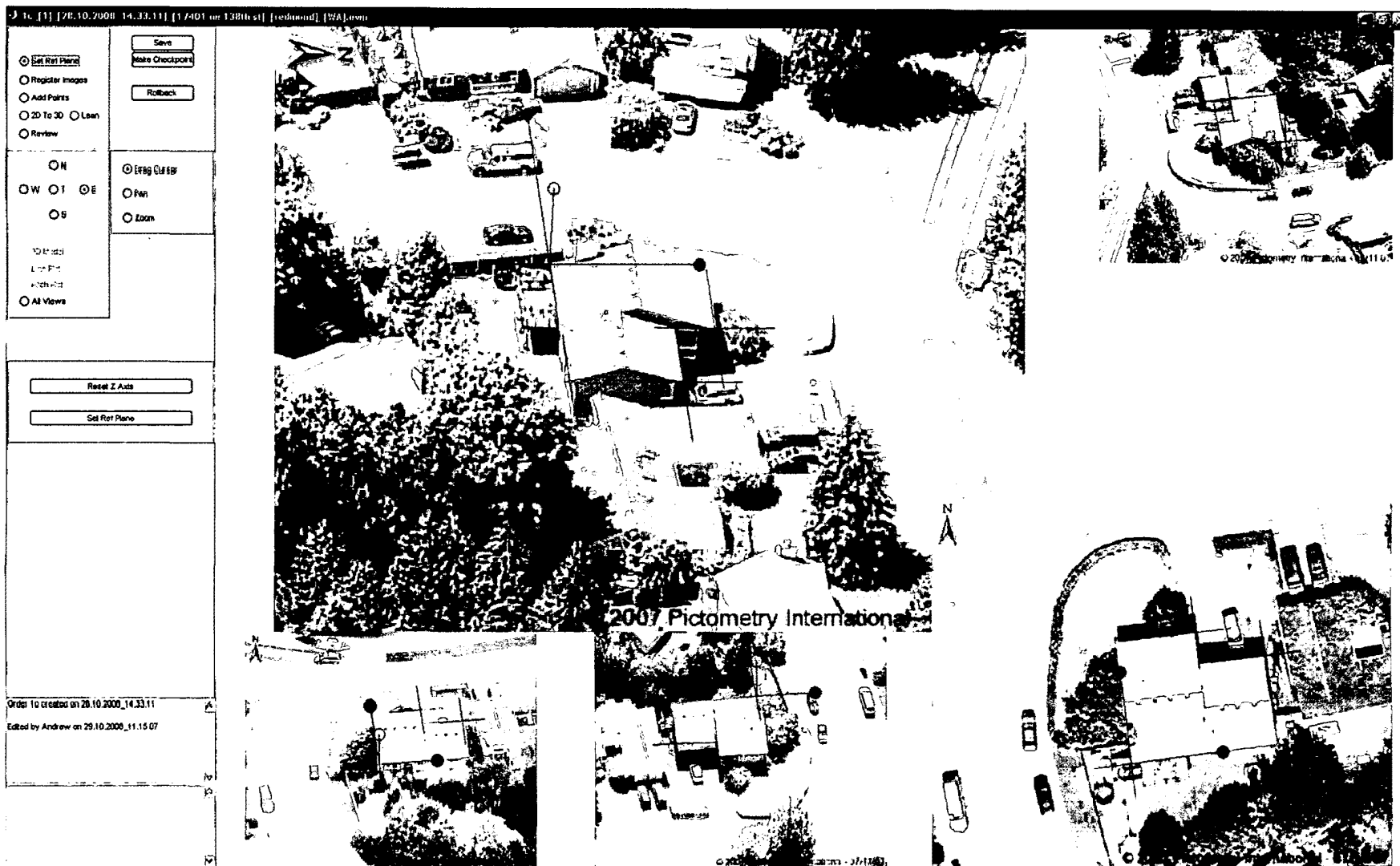


FIG. 9



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Express Mail No. EV93484416AUS

FIG. 10

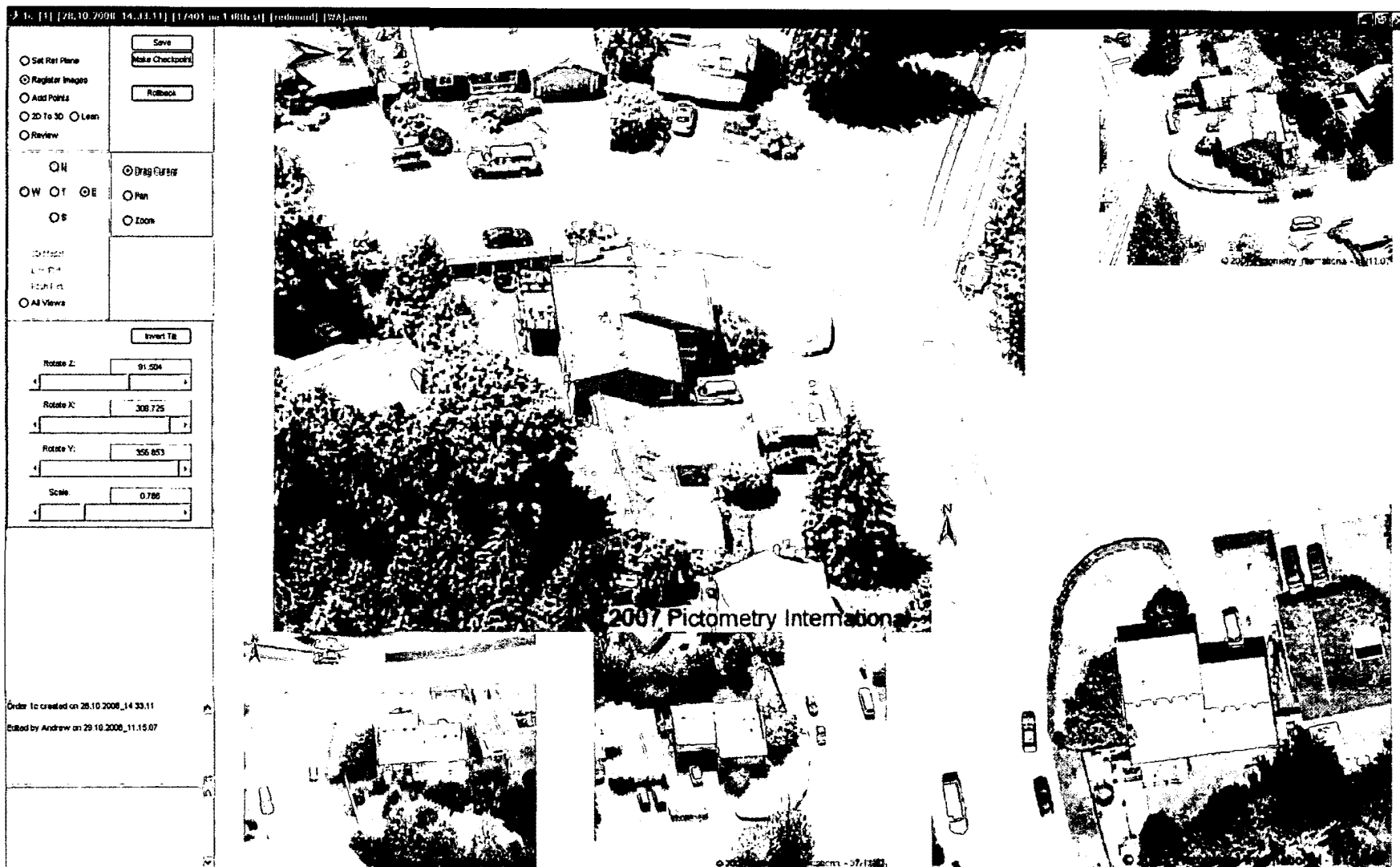


FIG. 11



FIG. 12



FIG. 13

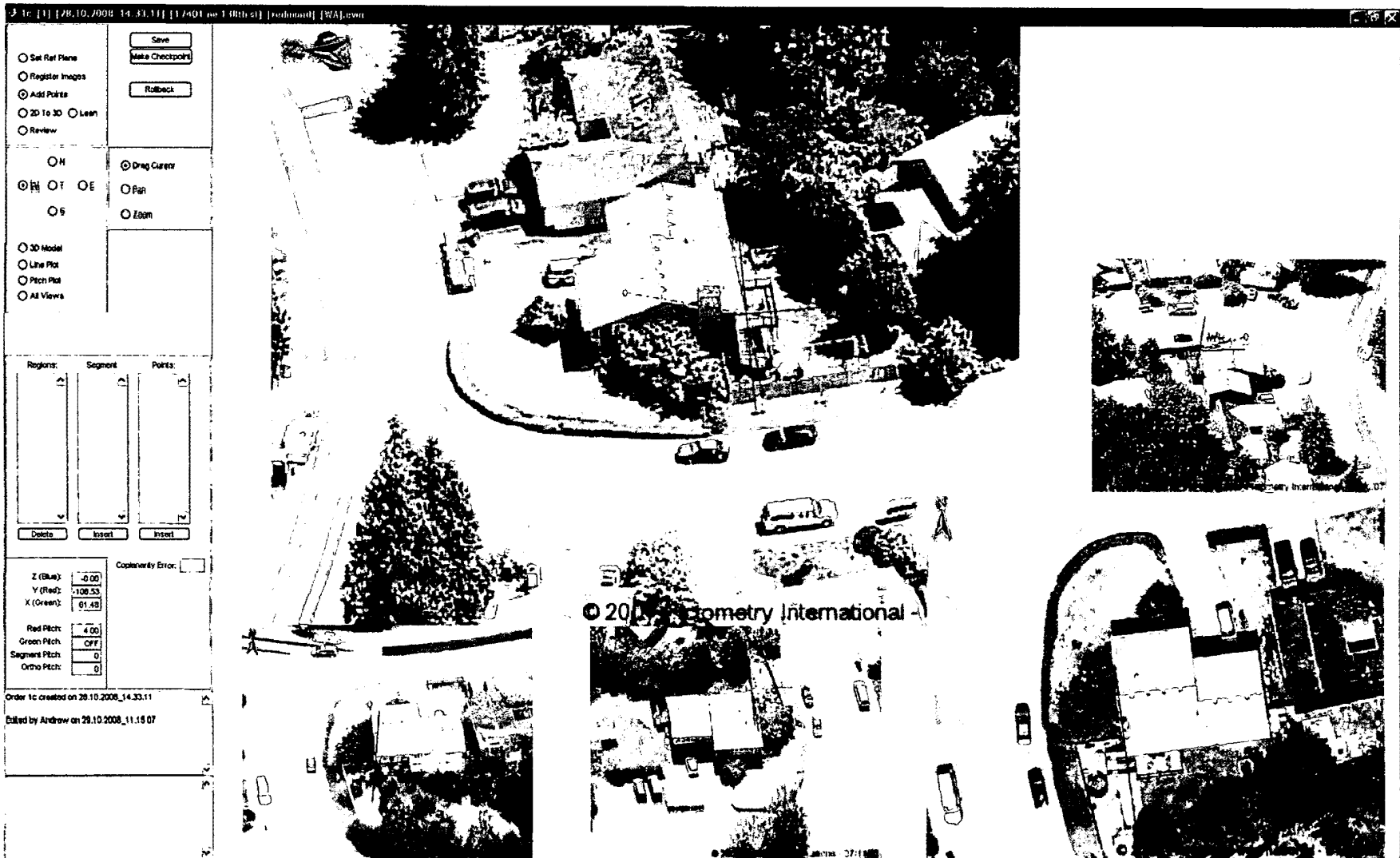


FIG. 14



FIG. 15



FIG. 16

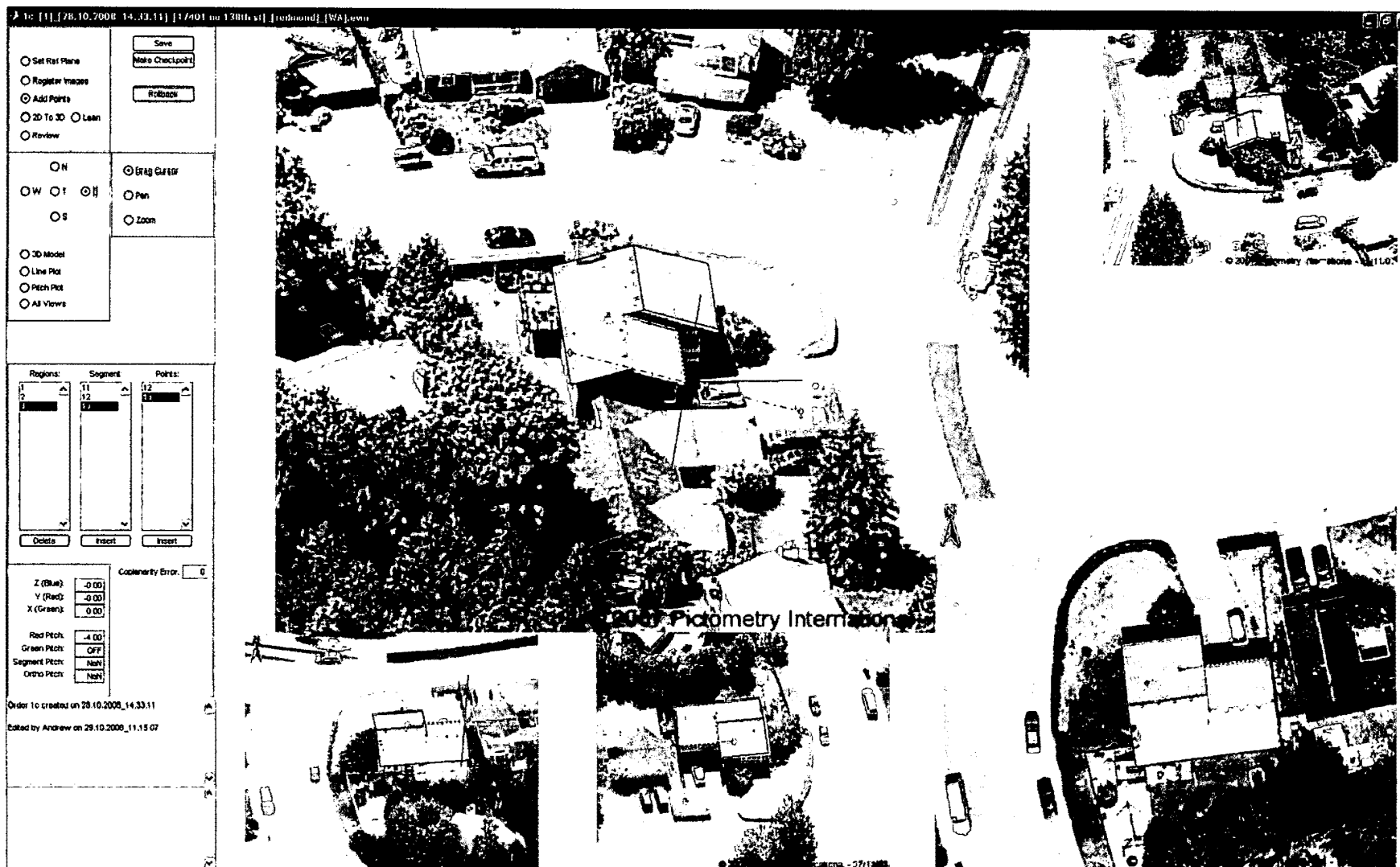


FIG. 17

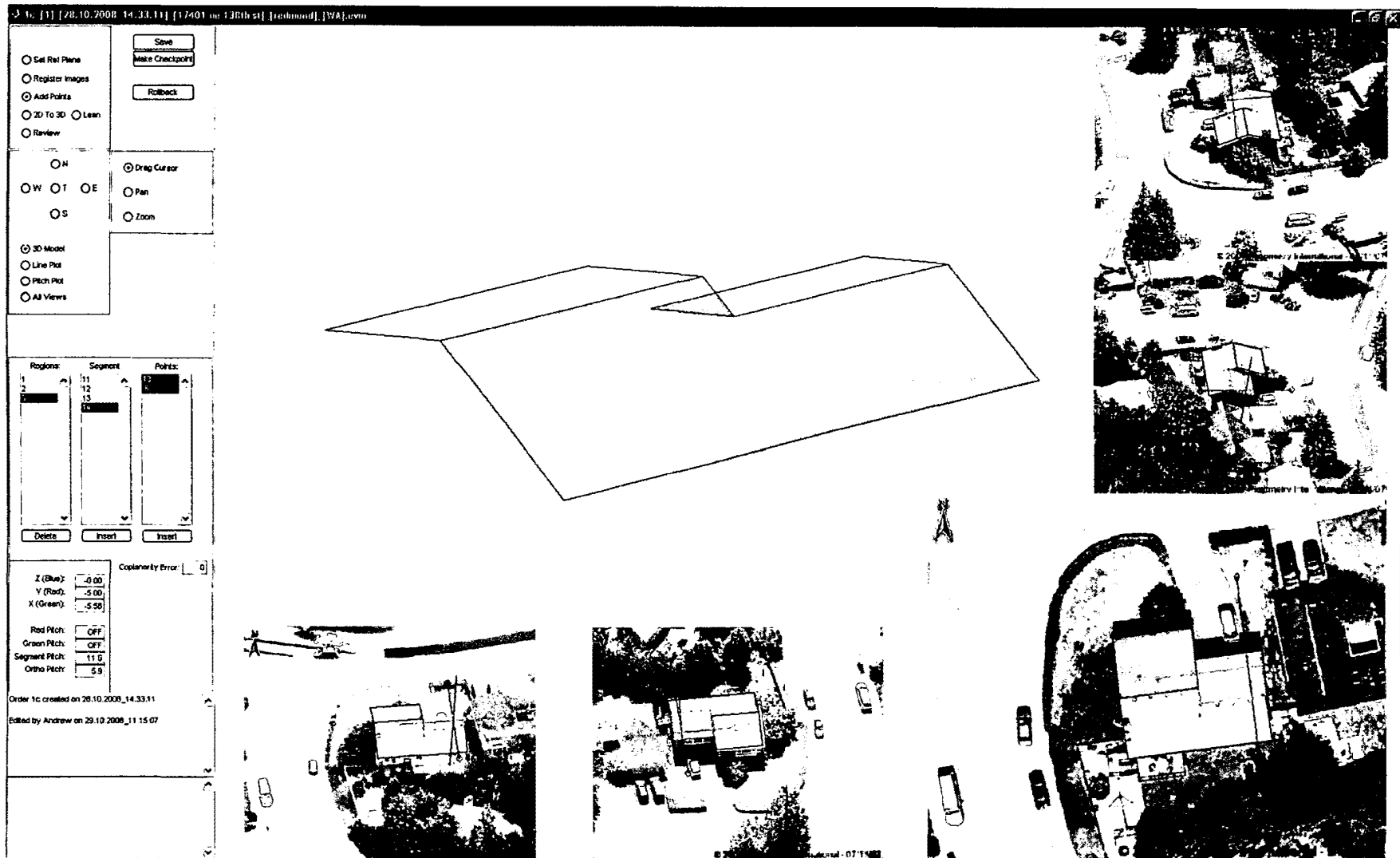


FIG. 18



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 Inventor(s): Chris Pershing et al.
 Express Mail No. EV9348416AUS

FIG. 19



FIG. 20

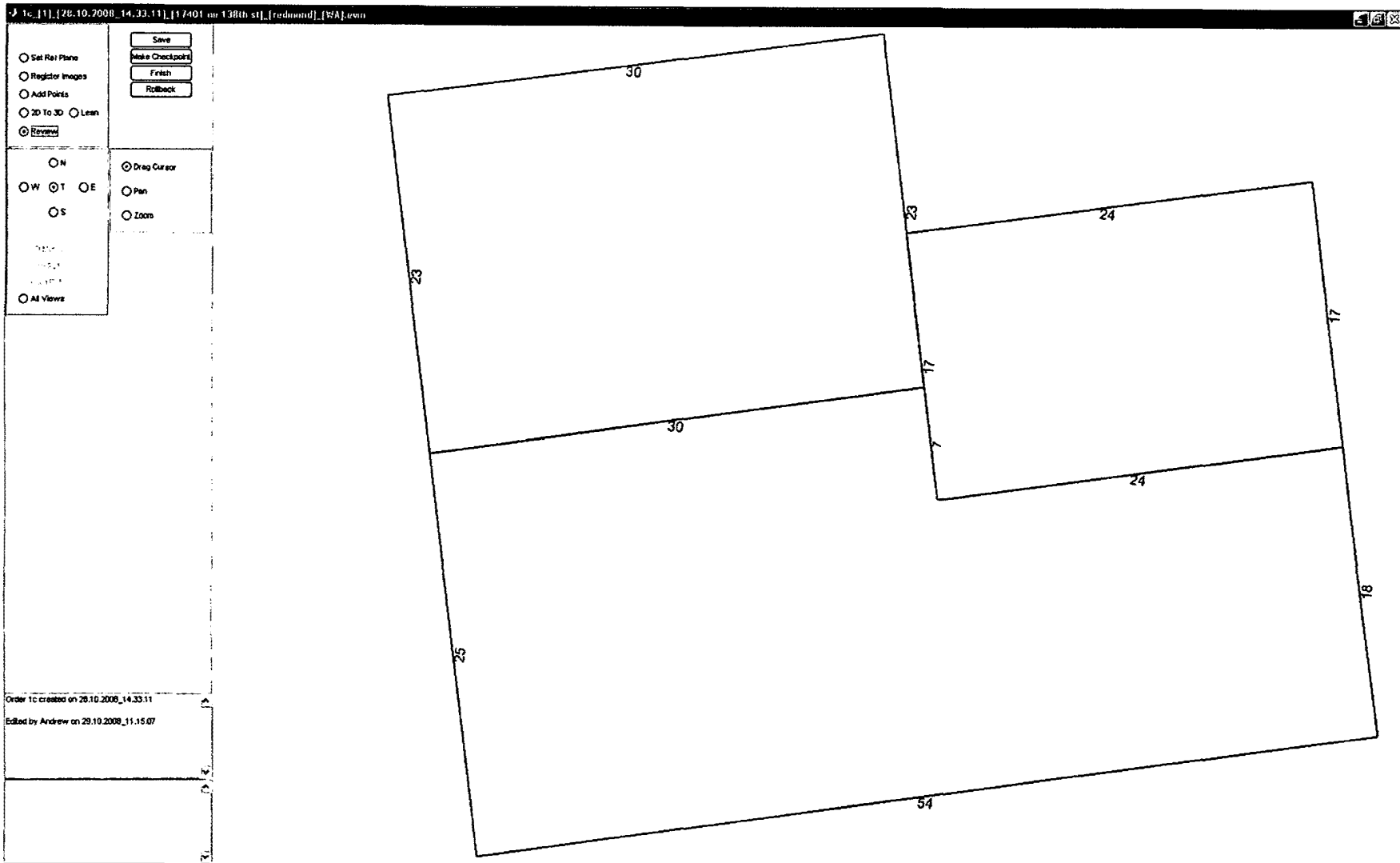


FIG. 21



FIG. 22



FIG. 23

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