

Straw Bale Building In Alaska

A CCHRC Presentation

FOUR NON LOAD BEARING HOMES AND A
LOAD BEARING GARAGE IN THE
FAIRBANKS AREA

2003



THE FOLLOWING SLIDES ARE PRESENTED

BY

GERALD GOODMAN

**IN COOPERATION WITH THE COLD CLIMATE
HOUSING RESEARCH CENTER**

THIS PRESENTATION SHOWS FIVE STRAW BALE BUILDINGS IN THE FAIRBANKS AREA. FOUR OF THESE ARE OF NON-LOAD BEARING STRUCTURE AND ONE IS LOAD BEARING. THESE ARE PICTURES THAT WERE TAKEN BY GERALD GOODMAN, THE BUILDERS, AND THE OWNERS OF THESE STRUCTURES.

Jose & Helena Reuters's Straw Bale Home

Off Farmers Loop, Fairbanks, Alaska

- This home is built over permafrost and is supported on a Triodetic Multi Point Foundation frame work which allows it to be leveled or moved when necessary. The straw is stacked on an 18” ledge on the outside of a 2” X 4” framed home. It also has a vapor barrier covering the Oriented Strand Board (OSB) on the outside of the wall. The bales & siding are held in place using acoustic screws & wire.

Acoustic ceiling screws are screwed into the outside paneling & into the studs on 2' centers at the top of every other row of bales. Two wires are looped through the eye and back about 10" past the edge of the bale. These are used to hold the bales tightly to the wall and to also hold the vertical 2" X 4" framing studs which in turn are used to hold the siding.



Straw from Eugene Gilbert's farm in Delta is being delivered on time for the stacking party. Eugene is tossing the straw from his truck for Helena and Jose's new straw bale house.



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A Triodetic Multi Point Space Frame as a foundation.



Notice the window bucks and ledge on the outside of the envelope.



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Each volunteer was assigned a task while cutting and retying the bales and became very adept within a short time.



Straw is moved under a blue tarp to keep the bales dry.



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The first row of bales is laid on the ledge. Notice the vapor retarder on the outside and the window openings.



Bales are stacked around the window bucks. The rebar is driven through 1 1/2 bales, and then wire is run through the acoustic screw and wrapped around it which holds the bales tightly against the wall.



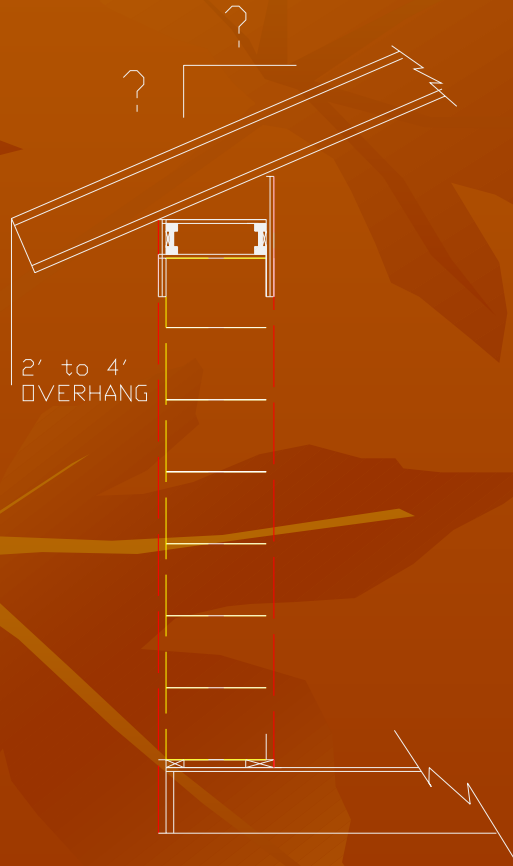
The south side of the Rueter house. The entire house is wrapped in steel siding which has a twenty five year warranty. Low maintance was the goal of this family.



Helena's Load Bearing Garage

- Helena designed and constructed this garage to show the feasibility of building a load bearing structure in the Interior. The walls of this building were erected in one day by 4 people.
- It is heated by a heat pump which dumps its cooled liquid into the space below the building to keep the permafrost frozen.
- In the Spring of 2004 the building will be plastered on the inside and outside walls.

This Is A Load Bearing Wall Section



ROOF TRUSSES OR "1" JOIST ATTACHED WITH SIMPSON TIES, R-38 INSULATION (at least)

"1" JOIST BOX BEAM ROOF PLATE WITH $\frac{3}{4}$ " PLYWOOD TOP AND BOTTOM AND THE SIDES. THE SIDES EXTEND DOWN OVER THE STRAW ABOUT 8" AND CAN BE FURRED OUT TO $1\frac{1}{2}$ " TO SUPPORT SIDING

STUCCO NETTING PINNED TO STRAW AND NAILED TO TOP AND BOTTOM PLATES OR VERTICAL 2" x 4" STUDS ARE ATTACHED ON 24" CENTERS FOR SIDING.

"1" JOIST BOX BEAM HEADER STRAPPED TO UNDER SIDE OF JOIST USING #9 WIRE OR FIBER STRAPPING TO PRELOAD THE STRAW

STRAW STACKED FLAT IN BRICK LIKE FASHION

$1\frac{1}{2}$ " OF STUCCO APPLIED IN 3 COATS OR SOME TYPE OF SIDING CONNECTED TO NAILERS ON 24" CENTERS

2 x 4's LAID ON SIDE TO RAISE THE BALE OFF THE FLOOR

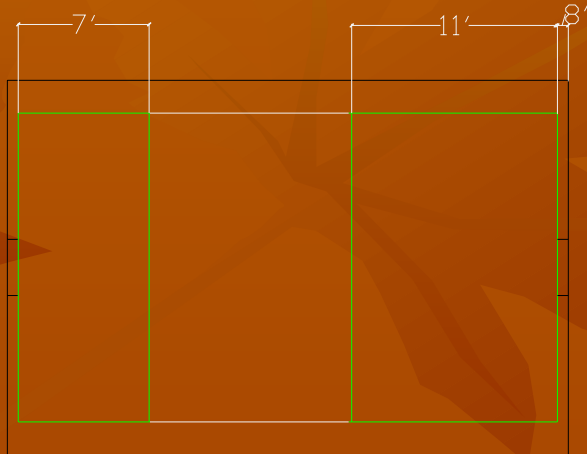
$1\frac{1}{2}$ " SOY BASED FOAM BETWEEN 2 X's
6 MIL VISQUEEN VAPOR RETARDER

$\frac{3}{4}$ " TONGUE & GROOVE GLUED & SCREWED

VAPOR RETARDER
12" "1" JOIST ON 16" CENTERS, 2 x 12 RIM JOIST

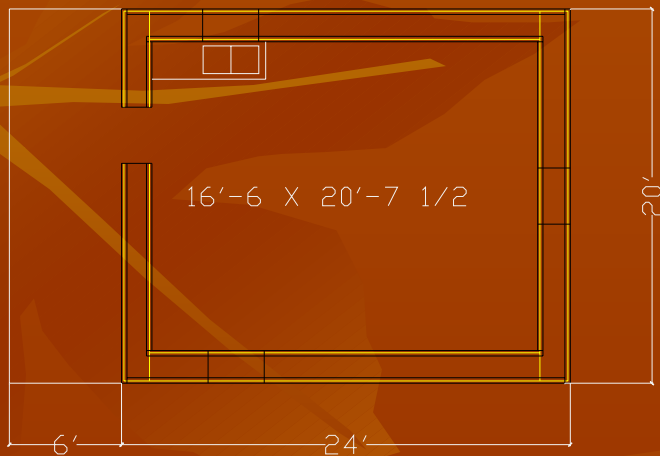
This Building Is A Simple Load Bearing Structure

OPTIONAL LOFT SPACE FOR SLEEPING AND/OR STORAGE



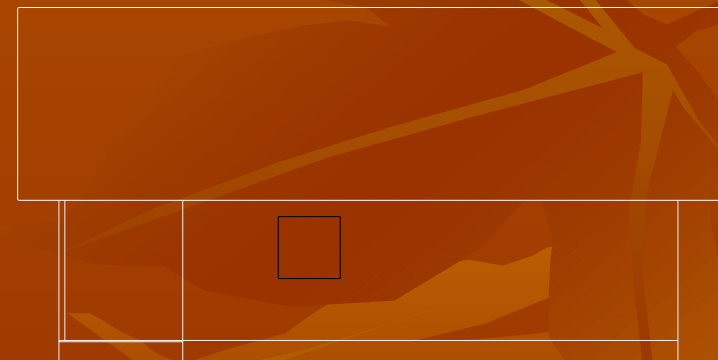
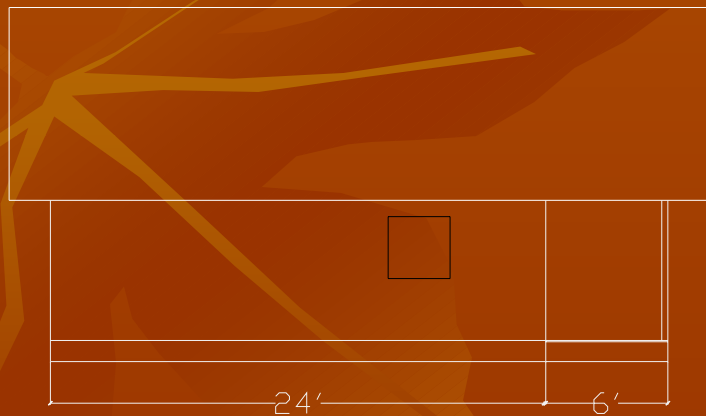
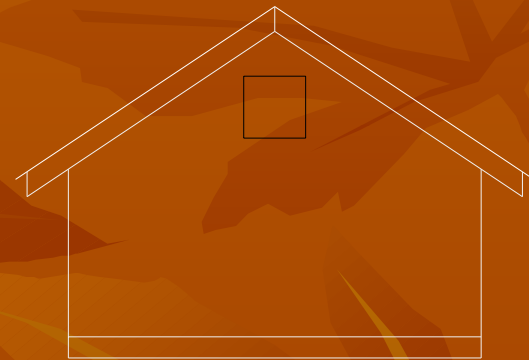
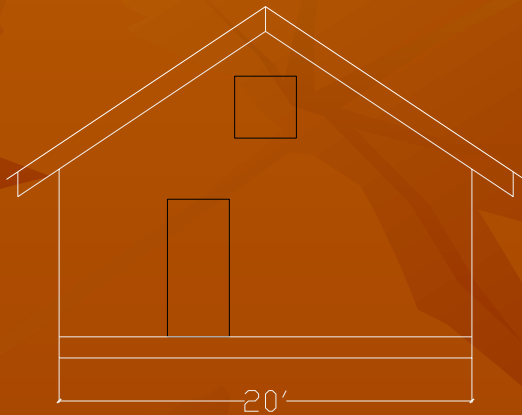
THIS SET OF PLANS IS NOT COMPLETE AND IS MEANT ONLY AS GUIDE TO GIVE YOU A STARTING POINT FOR YOUR OWN PLANS.

A GOOD SET OF PLANS WILL SAVE YOU A LOT OF MONEY AND TIME AS YOU BUILD AND MAKE IT EASIER TO GET BIDS ON MATERIALS. DON'T BUILD WITHOUT THEM!



THE MAIN LEVEL MAY BE SET ON ANY TYPE FOUNDATION AND HAVE ANY FLOOR PLAN. PLANS COULD INCLUDE PLUMBING AND ELECTRICAL DETAILS. THE BUILDING MAY BE LARGER OR SMALLER TO FIT YOUR INDIVIDUAL NEEDS.

Typical Alaskan cabin not showing details such as siding, roofing, windows, doors, etc. Those details should be designed to fit the needs of the owner.



Helena's load bearing garage forms were constructed over permafrost. A heat pump is used to cool the earth below and to heat the slab. This monolithic pour is over 8" of foam.



Corner bracing is used to keep the bales in line and to form uniform corners.



The “I” beam top roof plate assembly is ready to place as soon as the bales are stacked.



The sensor in the center of the floor is for the heat pump monitoring system.



Cooling tubes are inserted into the earth below the floor to keep the ground frozen.



Helena Reuter is pouring and finishing her floor.



The floor and footers are poured with 2 x 4's inset into the concrete to use as nailers for the mesh lath around the perimeter. Note the foam on top which will act as a vapor retarder and capillary break.



Helena Rueter and Sandy Romero stack the first row of bales.



Four of the seven rows are finished at this point, and the wall is quite unstable. Once the wall is preloaded using the #9 wire and a special ratchet-like tool which is used to pull the wall down (preload), it becomes very stable.



Jose sets the top plate and fastens the corners together. After the top plate is set the bales are preloaded using #9 wire run under the foundation and over the top plate.



Stacking straw is fun and can involve the entire family.



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The roof has three feet of overhang on the north, west , and south, and five feet on the east. A non-load bearing home is seen in the back ground.



Colombo & Nancy's Non-Load Bearing Home In Ester, Alaska

- A vapor barrier was not planned when this home was built and the owners later retrofitted one. With no outside plaster skin, the wind blew straight through during the first winter, and it was very cold inside. Plastering is a problem in Fairbanks because of the length of time needed to apply and to dry at the end of the building season.

This single story is built on pilings and plastered with a concrete plaster mix.



The east end before a permanent door was installed.



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The south side is designed for passive solar gain.



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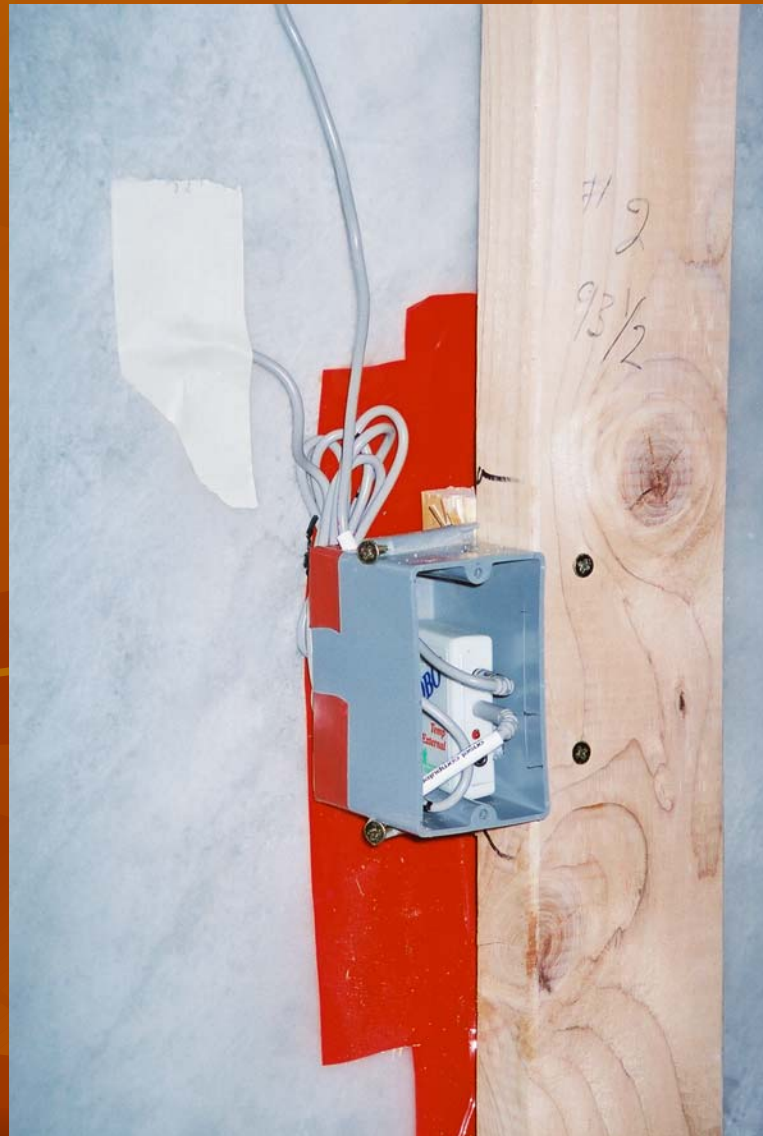
The vapor barrier is hung before furring out for sheetrock.



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An electrical box is used to house hobo sensors on the north wall.



A Toyo heater provides heat. Notice the furring for hanging the sheetrock.



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Some mold problems formed under the eaves as the result of air leakage during the winter before the vapor retarder was installed.



Kevin And Wendy's Straw Bale Home On The Old Nenana Hwy.

- This home is nearly as self sufficient and green as possible in this day and age. The owners are off the power grid and use photovoltaics and wind power to generate most of their electricity. Their heat is supplied from the sun, oil, and wood.
- Their SB home has straw in the floor, ceiling, and walls. This home is also non-load bearing with framed walls, and the straw is stacked on an 18" ledge on the outside. The vapor barrier was applied to the outside of the OSB, and the straw was then stacked against it.

This photo is taken from the Southwest and shows the passive solar windows and the wind generator.



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This view is of the west end. They have not yet decided on what finish to apply to the outside.



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This inside view shows the passive solar effect of the southern orientation.



The insulated shades can be raised and lowered from the inside to regulate passive solar heating.



A view from the garden.



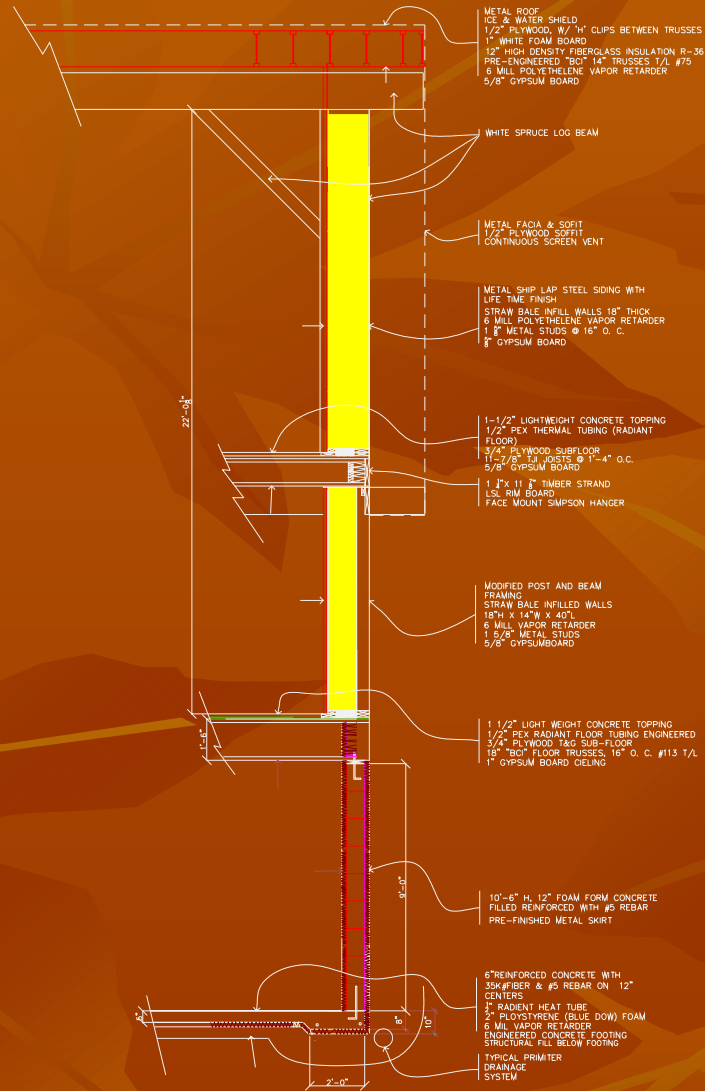
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Gerald And Joan's Home Off Cripple Creek Road In Ester, Ak

- This is a non-load bearing home finished with steel siding on the exterior and sheet rock on the inside. It is a modified Post and Lintel (Glulams™) construction with three large vertical white spruce poles and a large ridge pole. Steel was used to frame many of the interior walls. It is built on conventional footers and has foam form foundation walls. Passive solar radiation and oil supply the heat.

West Wall Of Goodman/Lessard Load Bearing Structure



The framing is done with 20' x 4" x 4" posts and
2" x 12" Glulamstm.



This shows the south wall in the basement. The west and north walls are from concrete filled foam forms. The framing is of 4" x 4"s and 2" x 12" Glulams™. The slab contains hot water radiant heating tubes.



This framing is in the north wall on the first floor. Notice the Simpson ties and strapping. The west roof support post is being raised



The post is tied to the wall system using rabbit joints, dado joints, and metal.



The east post is set into the cradle made of Simpson #10's bolted through 12" x 12" Glulams™ with 7/8" diameter bolts.



The west pole is being raised. The Simpson ties and strapping can be seen on the north wall.



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The 52' ridge pole is lowered into place. Notice the mortise and tenon joints.



**The diagonal braces are being installed on the ridge pole.
They are bolted through the joints with all thread.**



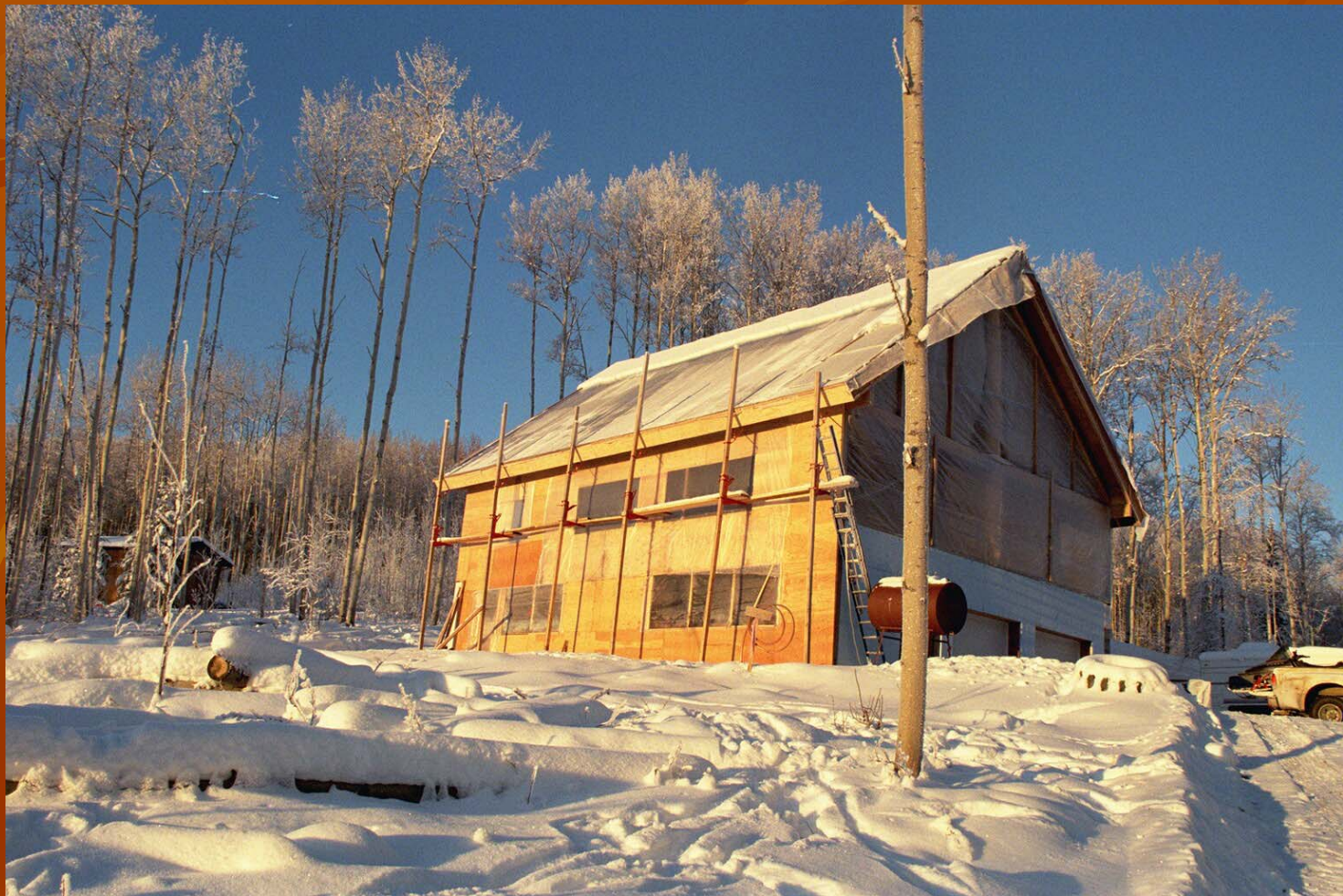
**It took three people and a block and tackle to raise the 16”
“I” joists for the roof. The blue tarp protected them
from rain**



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Closed in for the winter, the South face is sheeted with plywood for shear strength because of the many openings for windows and for the large 8' patio doors. Straw was stacked all during the winter.



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Steel hat channel is run vertically for attaching the siding to the wall with Tyvek underneath. The garage wall is a 2" x 6" framed wall with 2" of blue foam on the outside.



Most of the inside walls are framed with steel.



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**Straw was purchased from the
Miller farm in Delta Junction, Alaska.**



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Gerald uses the Bonker to move the straw into place. It is best to trim and make adjustments when each bale is added.



Straw is stacked in the master bedroom on the west wall. Notice the plywood ledge above the straw which is used as a fire block and helps to insulate between the “I” joist.



This shows detail in the ceiling. There is 12" (R-38) fiberglass between the webs, then 1" foam is placed between the flanges. Mathew is stuffing straw into the triangular space formed at the junction of the roof and straw.



Bales are stacked for the 21' east wall using scaffolding and a block and tackle . Notice the visqueen tabs which are part of the continuous air/vapor retarder system.



Straw is stacked in the north wall master bathroom. The 1 1/2" ledge allows for pouring the Gypcrete floor over radiant heating tubes.



The alcove around the post on the east wall is being framed. The space was filled with cellulose insulation which worked a lot better than trying to cut the bales to fit.



The “window bucks”, as they are called in the straw bale community, are being framed. The cavity is filled with straw and capped with OSB. The ledge on top of the Glulam™ was also filled with cellulose.



Window bucks on the east wall also serve as structural members to support the Glulams™.



The gap between the 1 5/8" studs and the vapor retarder is filled with sound bats to eliminate convection loops in the wall.



The east end is being sheet rocked. The alcove cavity was densely packed with cellulose after the rock was in place.



The truth window and the home made moisture meter were placed in the wall along with a hobo sensor. The hobo measures the temperature and humidity on the outside, middle, and the inside of the bales.



The finished living room, kitchen, and pantry (behind the kitchen wall) use 12v tech lighting with halogen bulbs.



The “great room” looks south. This view is from the loft.



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The sun shines on the north ceiling in December and illuminates the pantry and kitchen with natural lighting. Notice the tops of the upper cabinets.



Two small windows on the east wall provide lighting in the morning and the spruce logs enhance the ambience.



This is a view of the master bedroom looking north. The vanities and dressing area are on the north end of the room. The mirrored closet doors help provide light and give the illusion of a larger space.



Sunlight from the winter solstice on December 21st 2002.



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A wonderful day to be cozy behind straw bale walls!



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Study Conclusion

- There are four homes currently being monitored in the Fairbanks area. At the present they have been evaluated for almost two years. The author helped to build five straw bale structures, and in his opinion, which is supported with collected data, these homes are performing very well and are a viable building method in interior Alaska. These homes have all been sealed with air/vapor barriers and ventilated in some fashion which most professionals agree is the best way to build at this latitude.