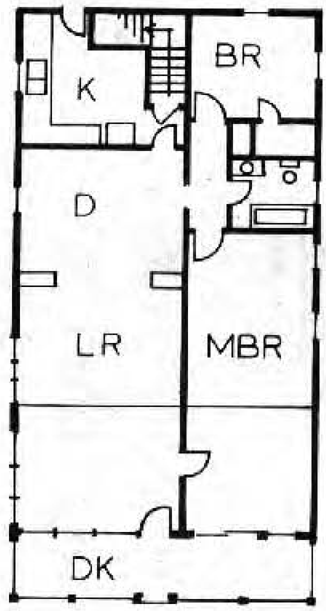
BOND

The Bond passive solar retrofit, the result of the Bond's desire to improve energy efficiency in their 60+ year old home (opposite is a photograph of a bungalow that closely resembled the pre-retrofitted Bond house), is a good example of how an existing home can be converted to a direct gain retrofit.

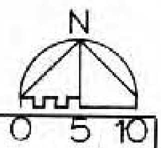
The Bond retrofit involved increasing the floor space of the home, increasing the insulation levels in the home, and increasing the direct gain glazing in the home. The floor space of the existing house was expanded by enclosing the porch at the southwest corner of the house. In what was formerly the attic of this enclosure, a loft overlooking the living area was also added. 2x4 studs were added to the inside of the existing house framing to create space for new batt insulation.

The new direct gain front wall of the Bond house is almost entirely glass, and the 165 sq ft of double pane glazing admits large amounts of sunlight. Because the original home contained virtually no thermal mass, 3.5" brick pavers were laid in the floor of the retrofit expansion to absorb some of the solar energy. A hot air redistribution system circulates solar heated air for space heating purposes. Excess heat is exhausted in summer. Currently, no night shutters are used to cover the new south glazing, and as a result heat loss may be severe.

The owner has had no leakage problems -- frequently associated with sloped glazing and commercial skylights -- with the non-operable, 48"x76" skylight he designed. He has also designed a condensate gutter for the skylight to prevent moisture condensing on the windows from rotting the skylight frame or dripping onto the floor.



MAIN LEVEL



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RATZLAFF

The need for study and studio space coupled with a desire to reduce energy consumption forced the Ratzlaffs to choose between building a new house and constructing an addition to their existing home in 1981. Their decision was to add a two-story passive solar retrofit and upper level deck to the kitchen and basement of the existing home.

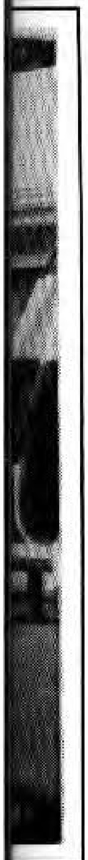
The addition, designed by Solar Energy Associates of Omaha, has 700 sq ft of floor space on each level. The upper level, which serves as an office and study for Dr. Ratzlaff, is also the location for a family-sized jacuzzi. The lower level is an art studio for Mrs. Ratzlaff.

The passive solar heating strategy chosen for the addition was a direct gain system with water wall storage -- Civil Defense water barrels which have been painted black to increase solar absorption (opposite right) -- on both levels. Backup heating to the addition is provided by a Morso wood burning stove on each level, and the owner is quite pleased with their performance.

Triple paned Andersen windows were chosen for the direct gain glazing of the retrofit. The windows are insulated with Window Quilts during the heating season. During the summer, the windows on the lower level are shaded by a deck accessible from the upper level, and the windows and sliding patio doors of the upper level are shaded by awnings. The owner reports that there have been some problems with water condensing inside one of the panes of the windows.

An active liquid flat plate collector system, installed by Arens Solar of Omaha, preheats water used in the bathroom and jacuzzi. The solar heated water is stored in a 120 gallon tank located in the basement and supplied as needed to a conventional 50 gallon gas water heater.

ROFIT



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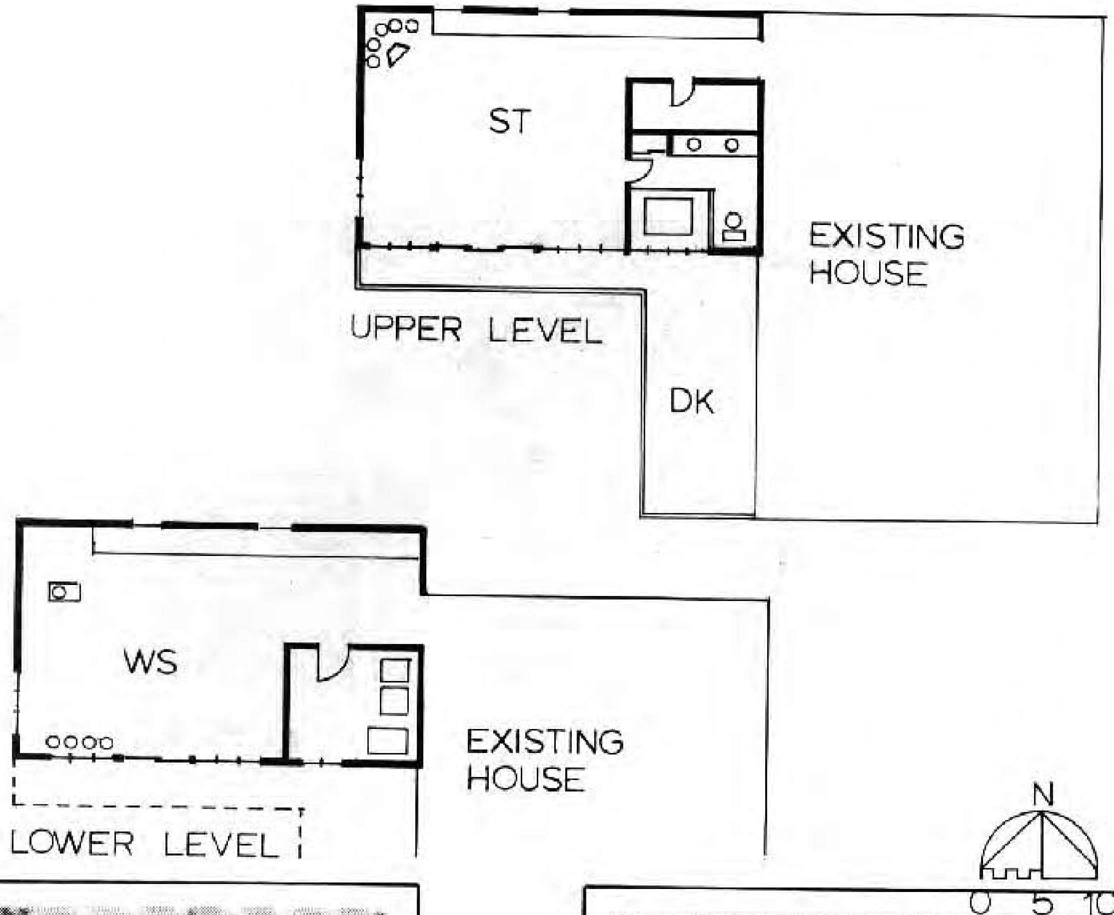

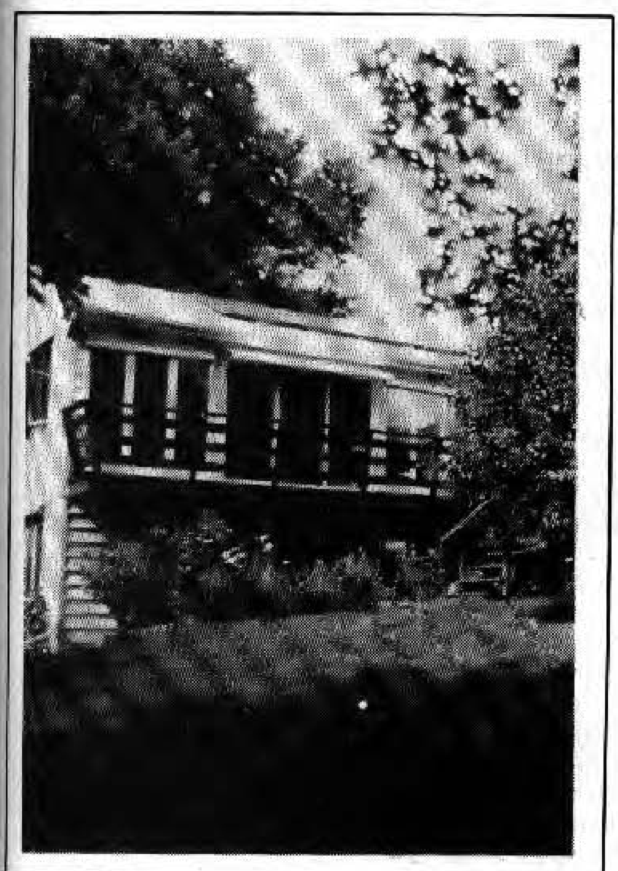

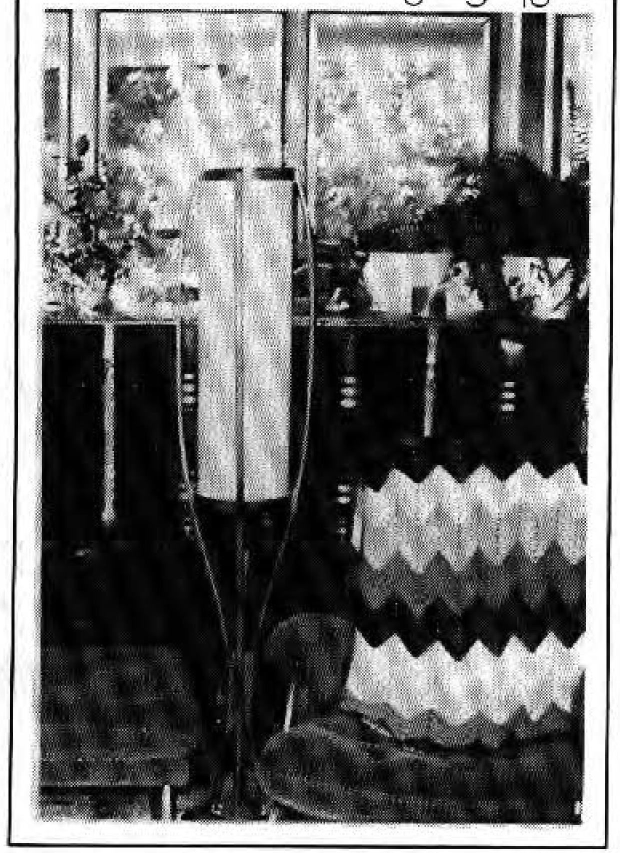

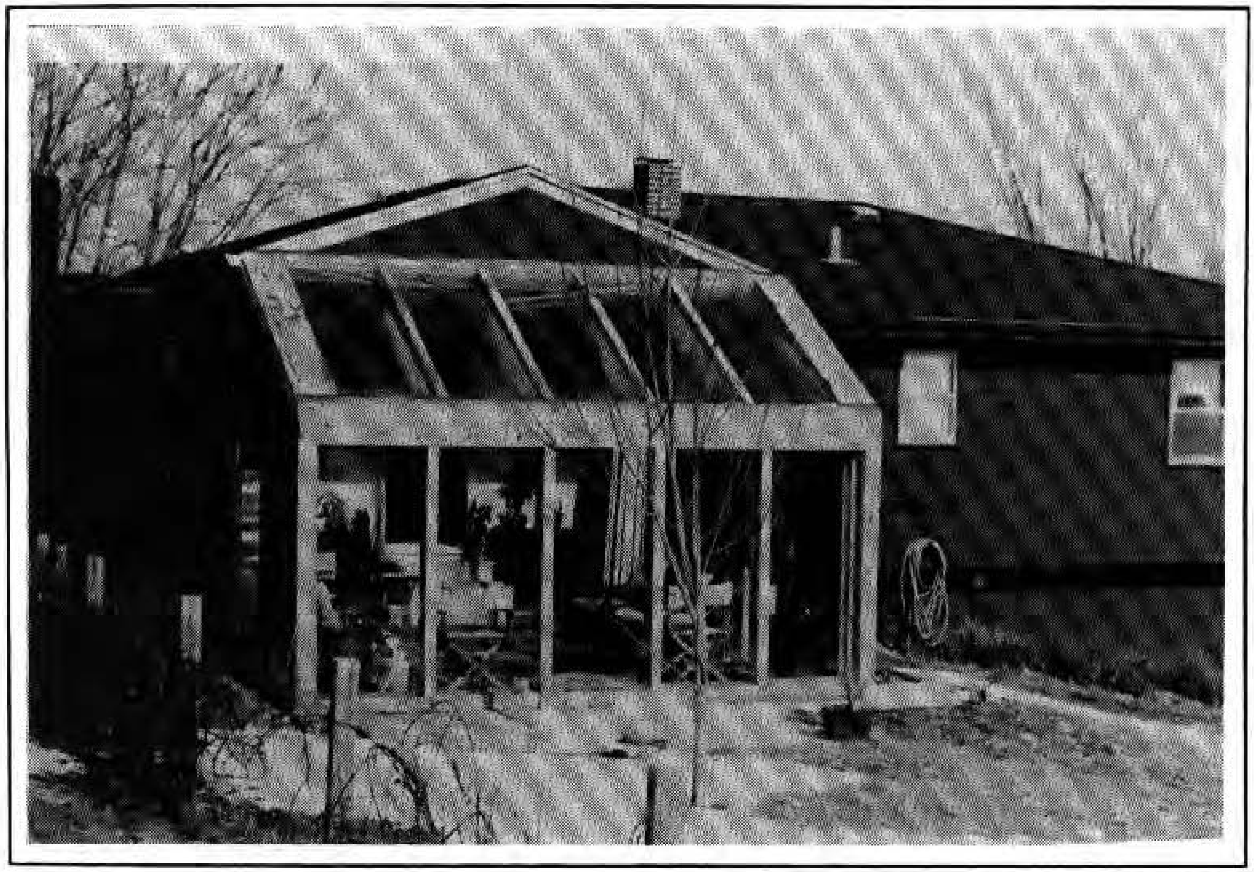

From calculations based on energy consumption records meticulously kept by the owner, it is obvious that the Shult sunspace retrofit has been the major improvement in a continuing effort to increase energy efficiency in the Shult home.

This effort began in 1974 when Shult lowered the thermostat setting for the gas furnace. As a result, the TIF for the house improved from approximately 6.5 to 5.6. In 1977, Shult installed a duct to provide outside combustion air to the furnace, and the TIF dropped to 5.0. The use of a fireplace added in 1978 to provide backup heating lowered the TIF value to 4.4. In 1981, the house was caulked and the attic insulation level was increased from R-19 to R-38. This reduced the TIF to 3.6.

The major impact on energy consumption occurred in 1982, however, when a step-down solarium was added to the south side of the house off the dining room. The use of solar heated air -- drawn through an opened window and door into the house from the greenhouse for space heating -- during the 1982-83 heating season lowered the TIF of the Shult house to its current level of 2.3.

Both vertical glazing and sloped glazing -- which must be shaded in summer -- are included in the greenhouse retrofit (opposite). Tile on the sunspace floor and water barrel mass storage are used as solar heat storage in the addition. Night insulating shutters which are attached and secured manually on the inside of the greenhouse glazing are needed during the winter because greenhouse temperature fluctuations can be severe. For example, in February 1983, when the mean outdoor temperature was 31°F with a low of 1°F above zero, the temperature inside the greenhouse ranged from 34°F to 99°F with a mean temperature of 57°F.

ROFIT

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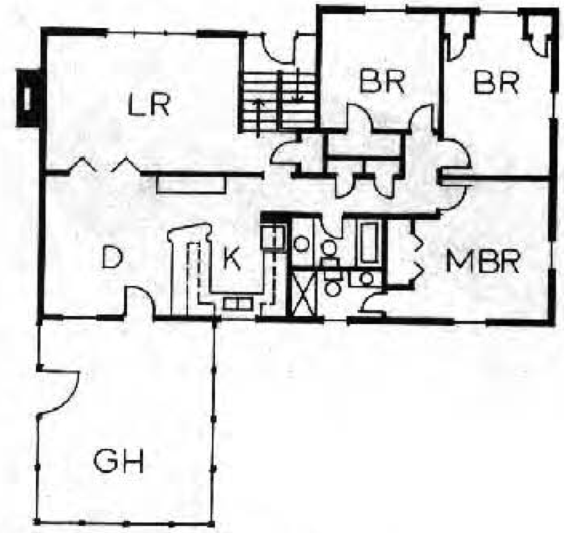

MAIN LEVEL