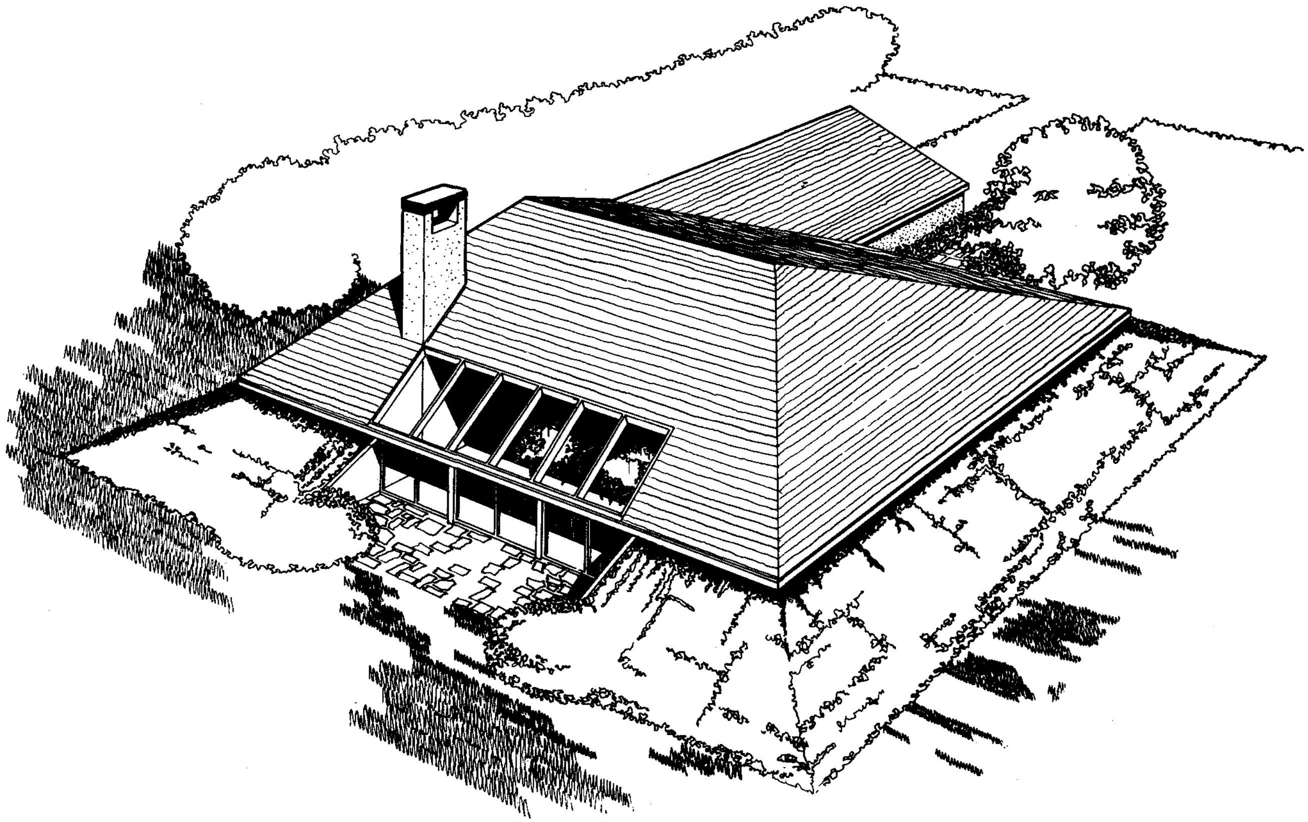
Upper Arlington, OH



Builder: H.R. Ranson, Inc., Columbus, OH

Designer: Walter S. Withers, Worthington, OH

Solar Designer: James M. Pabst, Columbus, OH

Price: $150,000

Net Heated Area: 2894 ft²

Heat Load: 68.7 x 10^6 BTU/yr

Degree Days: 5660

Solar Fraction: 52%

Auxiliary Heat: 2.03 BTU/DD/ft²

Passive Heating System(s): Isolated gain

Recognition Factors: Collector(s): Double-glazed atrium glass, 336 ft² **Absorber(s):** Concrete slab floor, poured concrete walls **Storage:** Concrete slab floors, poured concrete walls—**capacity:** 9600 BTU/°F **Distribution:** Radiation, natural and forced convection **Controls:** Dampers, ducts, insulating panels, thermostat

Back-up: Woodburning stove, electric resistance mats

The prominent design feature of this 3-bedroom house is the extensive earth berming on the east and west sides, which wraps around to partially berm the north and south walls as well. Sunlight is available to the living areas primarily through windows and sliding glass doors that face onto an atrium.

The primary **collector** in this single-level home is the double-glazed atrium, set into the south side of the building. At the north wall of the atrium there are also windows and sliding glass doors **collecting** light for the living spaces; this glass is also double.

The outermost collectors of the atrium-the skylights and sliding doors-pass solar radiation to be **absorbed** and **stored** by the 8-inch concrete slab floor within, and by the 8-inch poured concrete walls partially surrounding the atrium. All wall absorber surfaces in the atrium are stucco. The 4-inch slab floor in the living and dining rooms will also **absorb** and **store** heat.

Distribution involves radiation from storage masses and natural convection, but is for the most part by forced convection. In the winter mode, the dampers in the rafters between the skylight and vertical glass of the atrium are kept closed so that heated air can gather in the ceiling. A plenum in the ceiling has nine thermostatically **controlled** dampers: five supply air and four exhaust it.

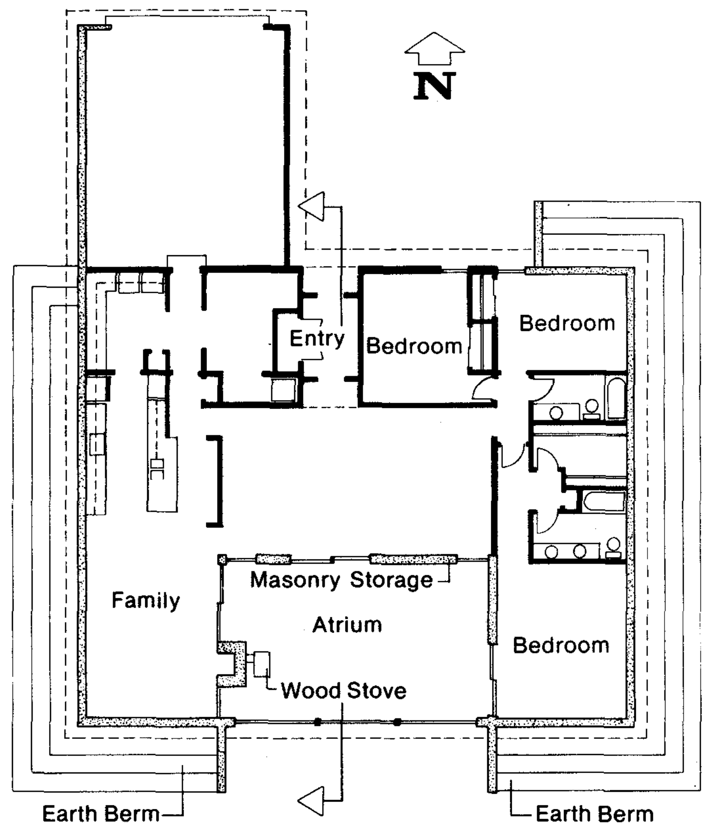
When heat is required, the supply air dampers open so that hot air can be drawn into the attic duct system by the furnace in the storage room. A manually operated damper within the central supply duct is moved to the open position, which allows the hot plenum air to reach the furnace. The furnace then **distributes** the air to all rooms through sub-slab ducts. Three separate sub-slab ducts allow cool air to be drawn back into the atrium from the living and dining areas for re-heating.

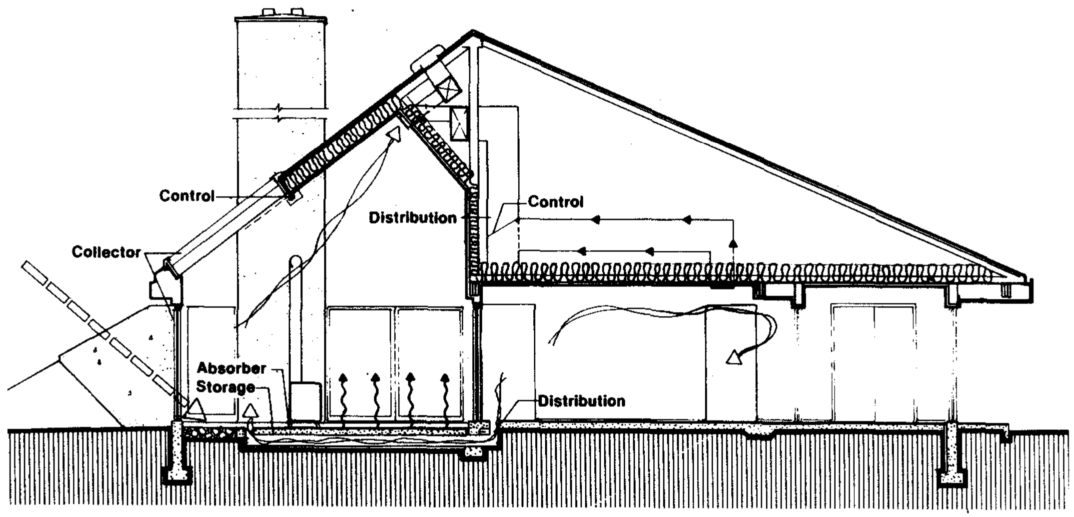
During extreme cold or at night, when the air being drawn from the atrium plenum is not hot enough to satisfy the house thermostat, electric coils within the furnace supply additional heat to meet the demand. To reduce dependency on the coils, there is a woodburning stove in the atrium. This stove shares the chimney used by the conventional fireplace in the family room. Additional back-up heat is available from electric resistance mats in the atrium slab floor.
The mats are thermostatically adjustable, but are designed to be used only if the temperature in the atrium drops below 50°F.

The atrium's heat loss is **controlled** at night by manually operated insulating panels (R10) that cover all exterior exposed glass. Roof insulation for the atrium is rated at R30. Blown insulation for the living area ceiling is R-50. The location of utility areas in the exposed (unbermed) northwest corner and the air-lock entry also help to buffer living areas from winter drafts.

In the summer mode, the dampers in the eaves are opened; this allows cool air to be drawn in as hot air is vented through open exhaust grilles to an air box in the plenum. There, it can either convect out naturally or be drawn out by a manually operated fan.

Air is continually mixed in the living areas by shifting the damper in the central supply duct to the closed position so that the furnace can circulate without drawing on hot plenum air. Insulation panels can also be used to shade the atrium storage masses.





This plan is from the book
“Passive Solar Homes – 91 new award-winning, energy-conserving single-family homes”,
The U.S. Department of Housing and Urban Development, **1982**

The solar homes designs in this book were the winners of HUD’s fifth (and final) cycle of demonstration solar homes. The 91 winning home plans in the book were selected from 550 applications from builders.

This was a time of great interest and activity in the passive solar home designs – many of the winning homes show a level of innovation not found in most of today’s passive solar designs.