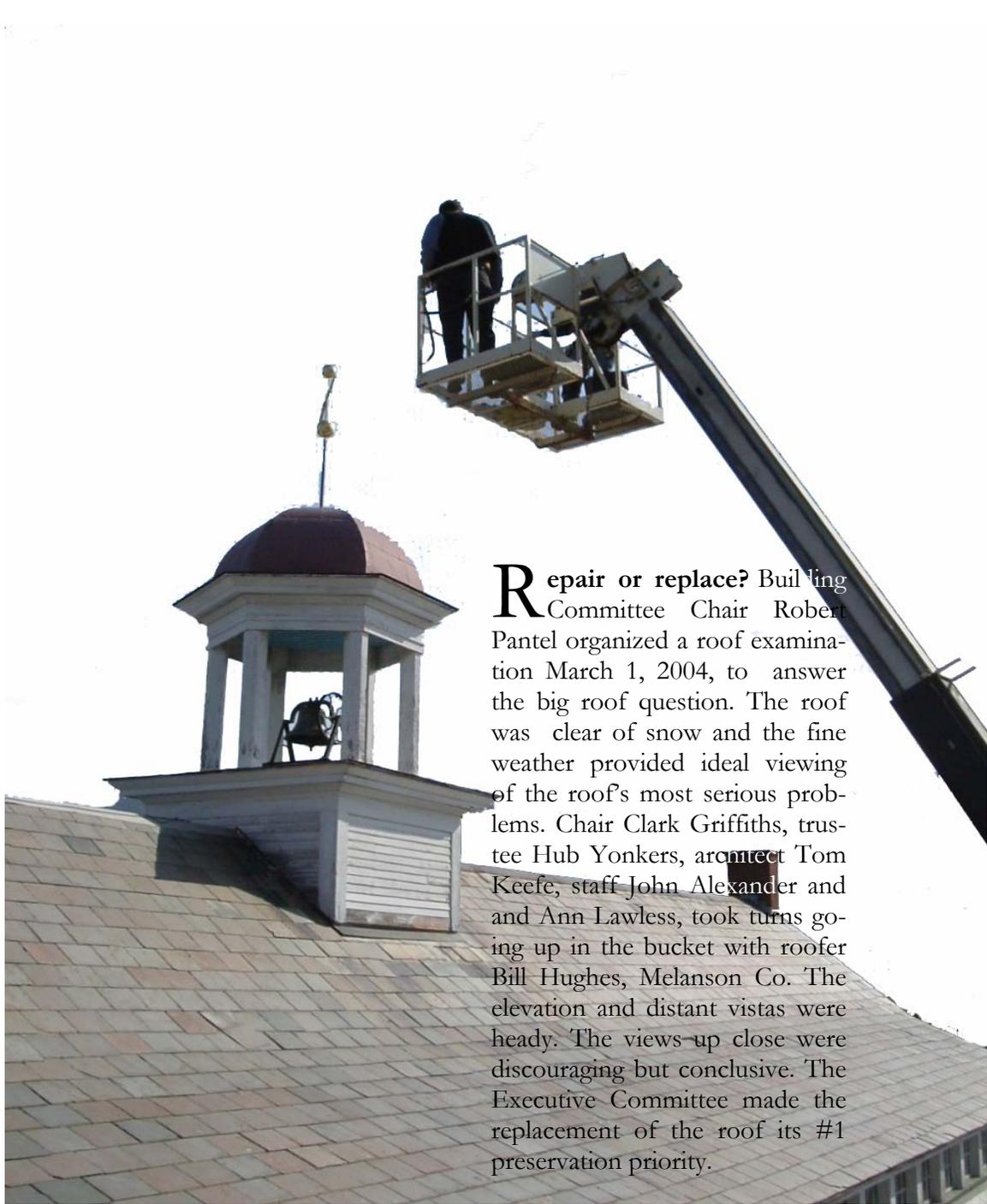


AMERICAN PRECISION MUSEUM
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PRESERVATION BULLETIN

VOLUME 1, ISSUE 2 JUNE 2004



Repair or replace? Building Committee Chair Robert Pantel organized a roof examination March 1, 2004, to answer the big roof question. The roof was clear of snow and the fine weather provided ideal viewing of the roof's most serious problems. Chair Clark Griffiths, trustee Hub Yonkers, architect Tom Keefe, staff John Alexander and Ann Lawless, took turns going up in the bucket with roofer Bill Hughes, Melanson Co. The elevation and distant vistas were heady. The views up close were discouraging but conclusive. The Executive Committee made the replacement of the roof its #1 preservation priority.

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SLATE

The most aesthetically pleasing and durable of all roofing materials, slate is indicative at once of the awesome powers of nature. Slate is a fine grained, crystalline rock derived from sediments of clay and fine silt which were deposited and consolidated into shale on ancient sea bottoms. Mountain building forces subsequently folded, crumpled, and compressed the shale, while intense heat and pressure metamorphosed it into slate. The geologic forces necessary to produce slate are dependent upon movements in the earth's crust and the heat and pressure generated thereby. Thus, slate is found only in certain mountainous regions, especially the Appalachians. It's likely that our Vermont "weathering green" slate came from the New York-Vermont district, nearby to the museum.



Slates no longer secured because of failing nails have slid down the roof and rest on the tower flashing. More lie to the right of the snow bank.

W **eathering.** The natural weathering of roofing slate is a slow process of chipping and scaling along the cleavage planes. Paper thin laminations flake off the surface and the slate becomes soft and spongy as the inner layers begin to delaminate. This process is chiefly due to mineral impurities (primarily calcite and iron sulfides) in the slate which react to form gypsum and rust. Because gypsum molecules take up about twice as much volume as calcite molecules, internal stresses cause the slate to delaminate. Ice causes the same effect. These chemical and physical changes cause an increase in absorption and a decrease in both strength and toughness. The tendency of old, weathered slates to absorb and hold moisture can lead to rot in underlying areas of wood sheathing. Weathered slates are more prone to breakage, loss of corners, cracking and slipping.

F **lashings** are sheet metal joints to prevent water entry between the various planes of the roof, such as in the valleys, along dormer walls, around chimneys. The most common older flashings were made of terne-coated steel—steel coated with a lead/tin combination, erroneously but commonly called "tin". Terne-coated steel must be painted regularly. Copper and lead-coated copper are durable, easily worked and require little maintenance. The use of dissimilar flashing metals and fasteners on the Armory roof has led to corrosion by galvanic action.

Metals used for flashing the roof cap, dormer and cupola sides must all be compatible metals—along with the nails.



Sheathing. In 1846 the Armory roof consisted of wood shingles over board sheathing. Ca 1880 when the slate was installed, two layers of wood shingles were left in place underneath. Moisture increasingly held in this relatively thick, now spongy underlayer prevents the nails from holding the slates firmly and prevents the slates from being evenly supported. Many slates have slipped.

Nails. Slate is typically attached to wooden sheathing with two nails driven through prepunched holes. Slate nails are not driven tight, but set so that the slate hangs freely on the nail shank. Nails driven too far will crack the slate and those left projecting will puncture the overlying slate. Slater's nails of bronze, copper or stainless steel are now used since plain steel and galvanized nails rust out long before the slate itself begins to deteriorate. Rusting of the Armory roof's 19th Century cut nails has caused slate loss. Nail heads left exposed accelerate roof deterioration by providing a way for water entry. Nails are rotating and bending as the sheathing deteriorates. Applying roofing sealants to exposed nails or nail holes is not viable because these materials, though effective at first, will eventually harden and crack, thereby allowing water to enter. Some react to ultra-violet radiation and deteriorate quickly.



Popped nails have worn holes from the underside into and right through the slates above them. Nail holes and cracks have been unsuccessfully treated with sealant.

THE PROJECT & THE SCHEDULE

As soon as we have the funds in hand to match the Save America's Treasures grant, we'll begin the roof and windows project, budgeted at \$400,000. The goal is to complete it by fall 04. Our architect is ready to put the roof project out to bid. Funds in hand after the roof is done will be used to start on the most needy of our 165 windows. Completing the windows and the masonry work will be part of the next phase. We have several grants pending.

SOURCES of FUNDS

Save America's Treasures	\$200,000
APM funds	27,500
Preservation Trust of VT/Freeman Foundation	50,000
Private Foundations	95,000
Total Match to date	372,500
Still to raise before we can start	27,500
Total Project	\$400,000

____ **Yes**, I want to support the Building Preservation Fund with a gift of \$ _____. Please make checks payable to *American Precision Museum* and mail to the address on p. 4. Please write your name as you would like it printed in our Annual Report:

Name: _____ **Address:** _____

City State Zip: _____ **Thank You!**



National Historical Landmark

American Precision Museum was founded in 1964 and designated a National Historic Landmark in 1966. In 1987, by virtue of the importance of its collections, reflecting major landmarks in machine tool development and innovation, the American Society of Mechanical Engineers designated it the first International Mechanical Engineering Heritage Site, housing an International Mechanical Engineering Heritage Collection. The Museum celebrates the birthplace of America's Industrial Revolution, where the concept of interchangeable parts was brought to practical perfection.

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Weathered, loose, cracked and slipped slates.

Beautiful to look at, slate roofs are simple, low-tech roofing systems made of natural materials: primarily stone with wood boards and metal fasteners. Slate roofs are sought after by the ecologically minded. When the entire life of the roof is taken into consideration, a slate roof is arguably the least expensive roof money can buy.

Recent roof repairs bought valuable time the museum used to undertake a comprehensive evaluation of the long term needs of the building, and to raise funds. Deferred maintenance of the Armory roof has made replacement an expensive but unavoidable prospect. The museum is committed to developing a long term preservation maintenance plan and an endowment to cover the costs over time, as part of the building's restoration. Thanks to many grants, helpers, and supporters we're well on our way to a new roof!