PDHonline Course C800 (3 PDH)

Audubon House: From Here to Sustainability

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Audubon House

From Here to Sustainability

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Part 1

A Breath of Fresh Air

Good Enough to Bottle

"It's been more than six months since the National Audubon Society moved its headquarters into what has been called one of the most environmentally friendly office buildings in the world. And while it will be a full year before the people who retrofitted the 102-year-old New York City building know for sure how well it's performing, Audubon staffers already know at least part of the answer…"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993

"…'The air in here is so fresh,' said Tom Exton, Audubon's corporate relations director. 'We have as close to a toxic-free environment as you can get. I can't emphasize enough how fresh the air is.' People who used to feel tired and suffer from headaches after a day at work now say they don't, Tom said. 'We're thinking of bottling the air,' staffer Dave McGowan added…"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993

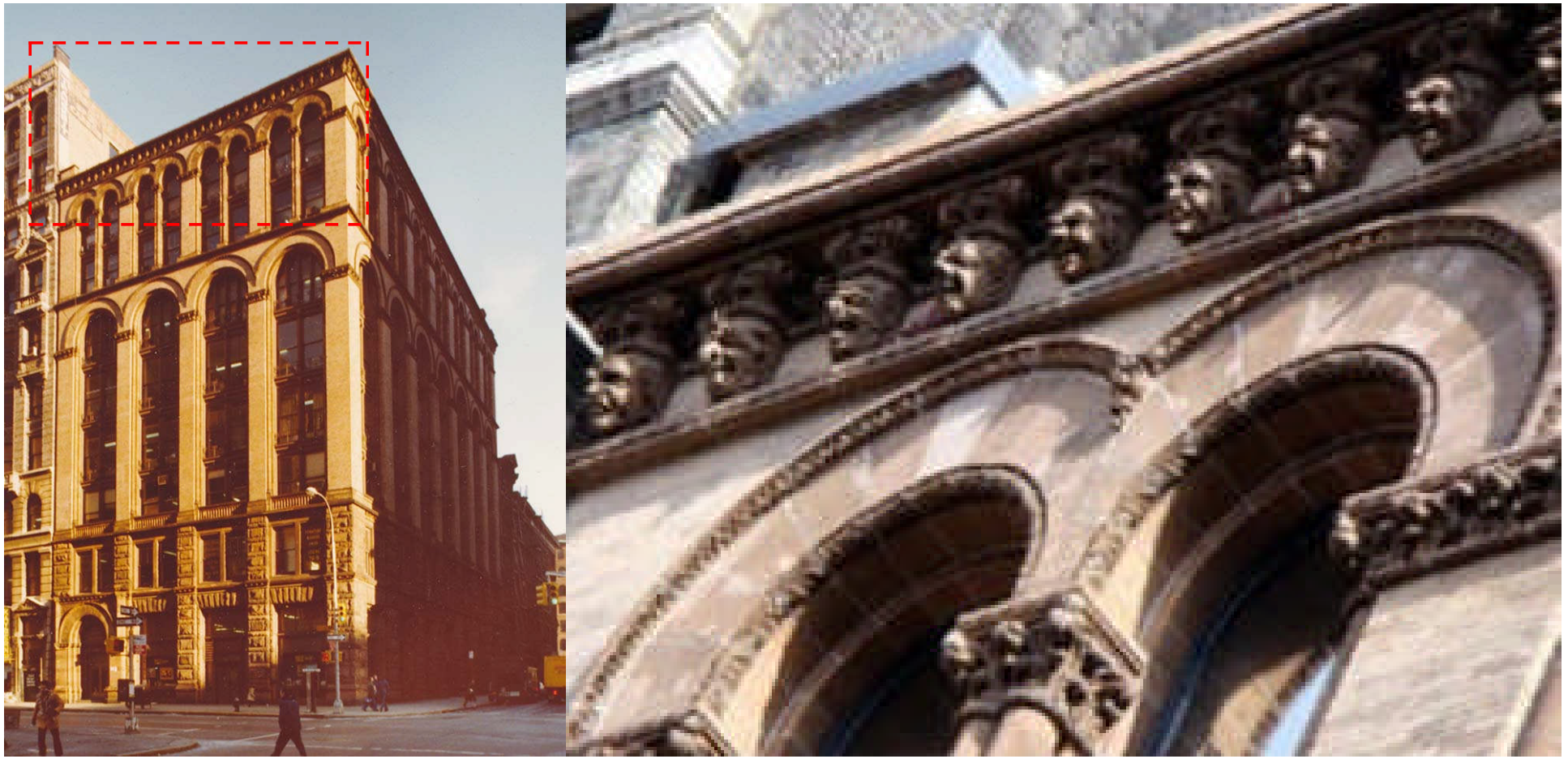
“I love coming here to work every day. I love knowing that I’m not breathing crud. In the other building I’d look up at the air vents and they were always full of grime. Maintenance people were in here cleaning the vents just yesterday. I like to see that.”

***Elizabeth Hax,* Executive Secretary, NAS Membership Dept.**

What’s Old is New Again

"…One of Audubon's first decisions was to retrofit an old building instead of spending an estimated $33 million on a new headquarters. The organization bought the Schermerhorn Building in 1989 for $10 million. Audubon then asked the Croxton Collaborative, a New York City architectural firm, to apply as many energy efficient and environmental technologies as could pay for themselves in three to five years. Total cost of the renovation was $14 million…"

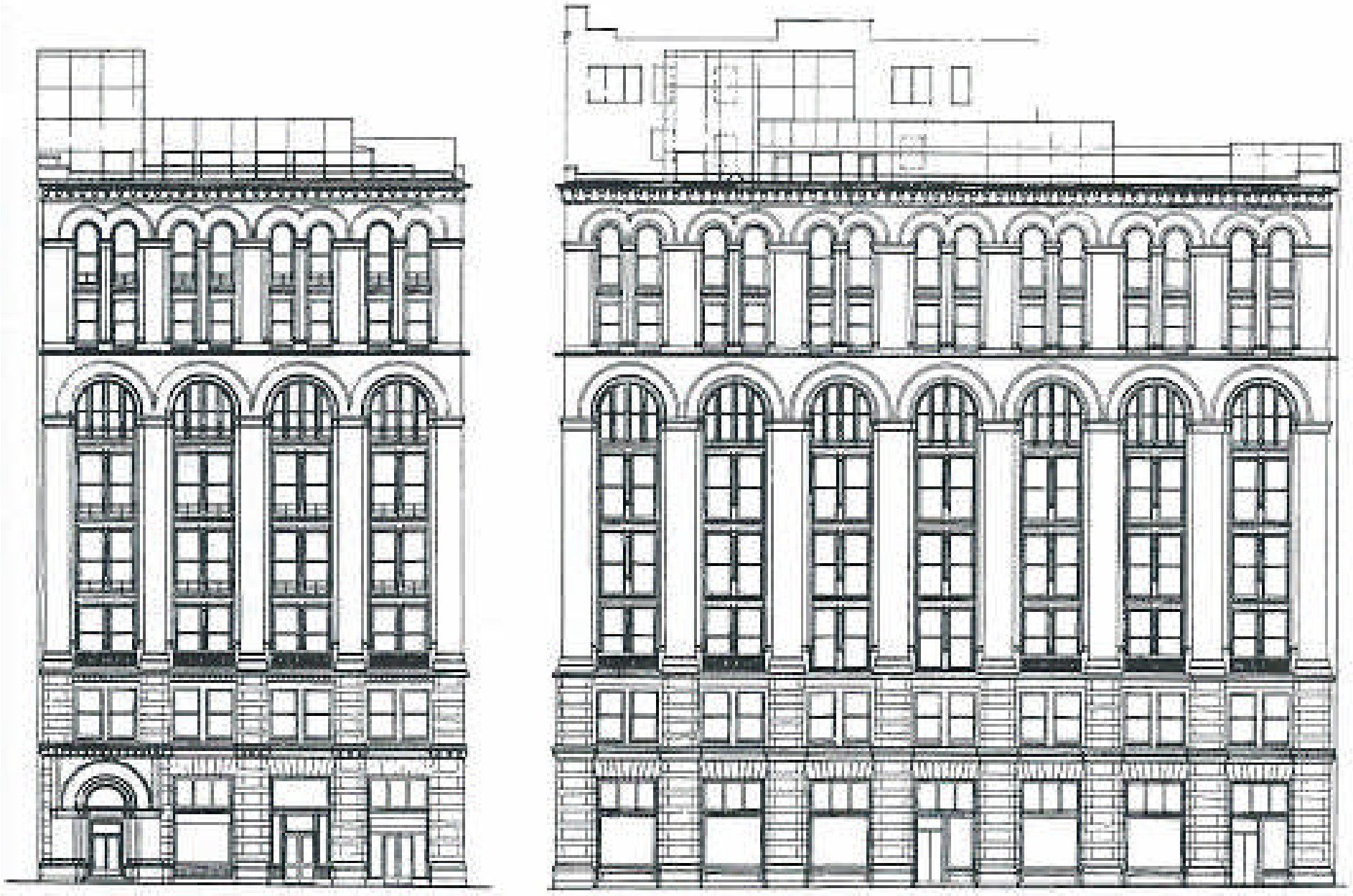
RE: excerpt from *Designing a Sustainable Future*, Spring 1993. The building is eight stories high (a penthouse was later added) with grand attenuated arched windows (there's a basement and sub-basement below grade). The structure has an exterior of sandstone (brownstone) masonry and terra-cotta. Just under the cornice line is a row of gargoyle faces (caricatures of political figures of the era in which it was erected). There's a total of 98K square-feet of office space. The cast-iron construction is supported by basement-level masonry piers (typical of late 19th Century NYC buildings).



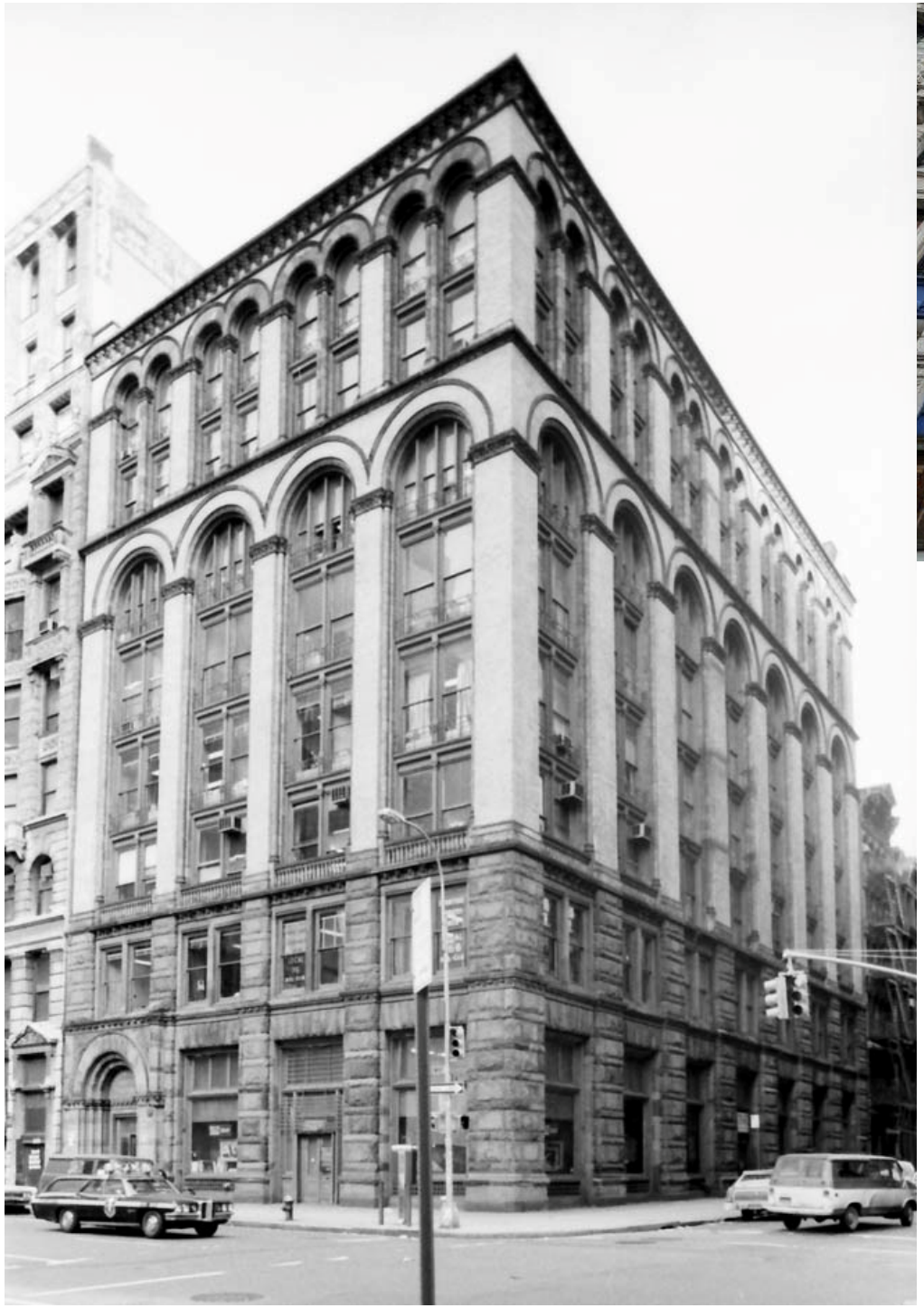
"From the 1840's to the early 1900's, the mile-long stretch of Broadway between Houston Street and Union Square bloss-omed as a bastion of New York aristocracy, thrived as a fancy shopping district and then hardened into an over-crowded garment district…"

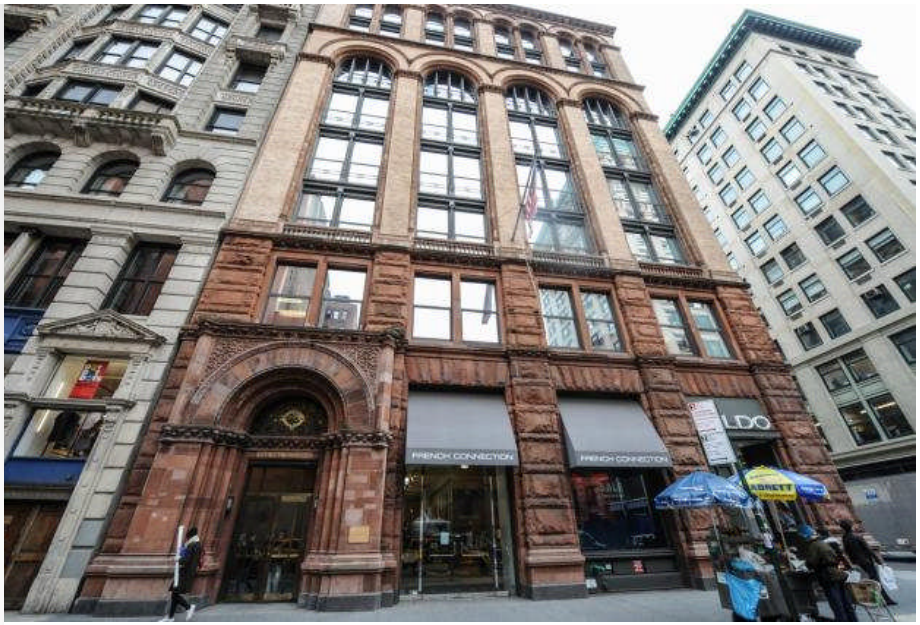
***The New York Times,* November 16th 1990**

RE: formerly the *Schermerhorn Building*, 700 Broadway is located on the corner of East 4th Street and Broadway in the Greenwich Village area of Manhattan (a/k/a "NOHO," short for "North of Houston Street"). The eight-story loft building was erected in 1891 and is a classic example of the "Romanesque Revival" architecture of the period. It was designed by noted architect *George B. Post*, whose other works include the *Williams-burg Savings Bank Building* (Downtown Brooklyn) and the *New York Stock Exchange* (Lower Manhattan). Originally, the building was designed by Post to be a store. After the turn-of-the-century, the structure was converted to showrooms, offices, storage and workshops, then it became lofts. The building was vacant and abandoned for most of the 1980s, until the *National Audubon Society* (NAS) purchased it for their national headquarters in 1989. In 1999, the building received desig-nation as a NYC Landmark building.



<u>Above</u>: caption: “700 Broadway – South and West Exterior Elevations”





"…One of the most powerful architectural compositions anywhere on Broadway is the Schermerhorn Building, No. 700. Four-story arched bays march boldly across its brick and terra-cotta facade, topped by two-story arches and a ring of human masks wearing grotesque facial expressions. It was completed in 1890 to designs by George B. Post and is now being recreated as Audubon House, headquarters of the National Audubon Society…"

***The New York Times*, Nov. 16th 1990**

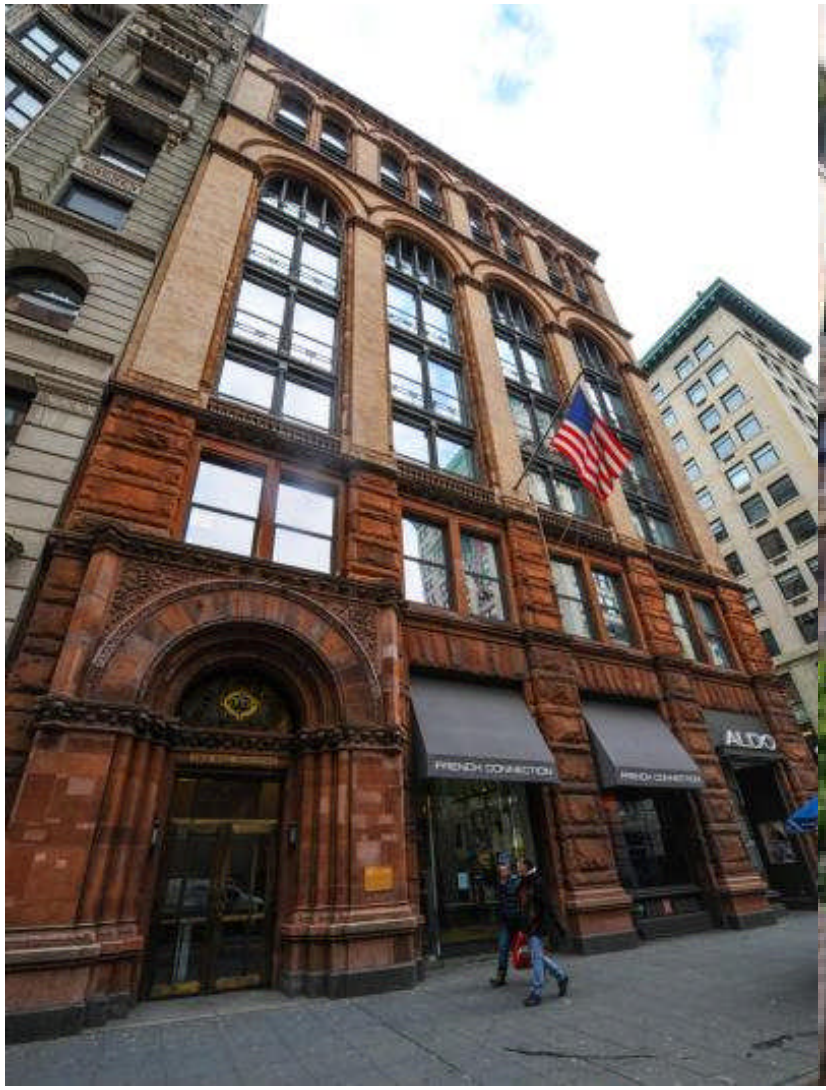

ALDO
ALDO
FRENCH CONNECTION
FRENCH CONNECTION
Broadway
ONE WAY
FRENCH CONNECTION
ALDO

"…The Schermerhorn Building begins a marvelous ensemble of nine towers whose features compete raucously for attention but create a remarkably harmonious whole. Nos. 708, 710 and 714 exemplify early skyscraper design, when steel frames made the narrowest sites usable. These are 10- or 11-story buildings on 25-foot lots, no wider than a typical brownstone. Richly adorned in decorative work, they look like ornamented slivers…"

***The New York Times*, November 16th 1990**

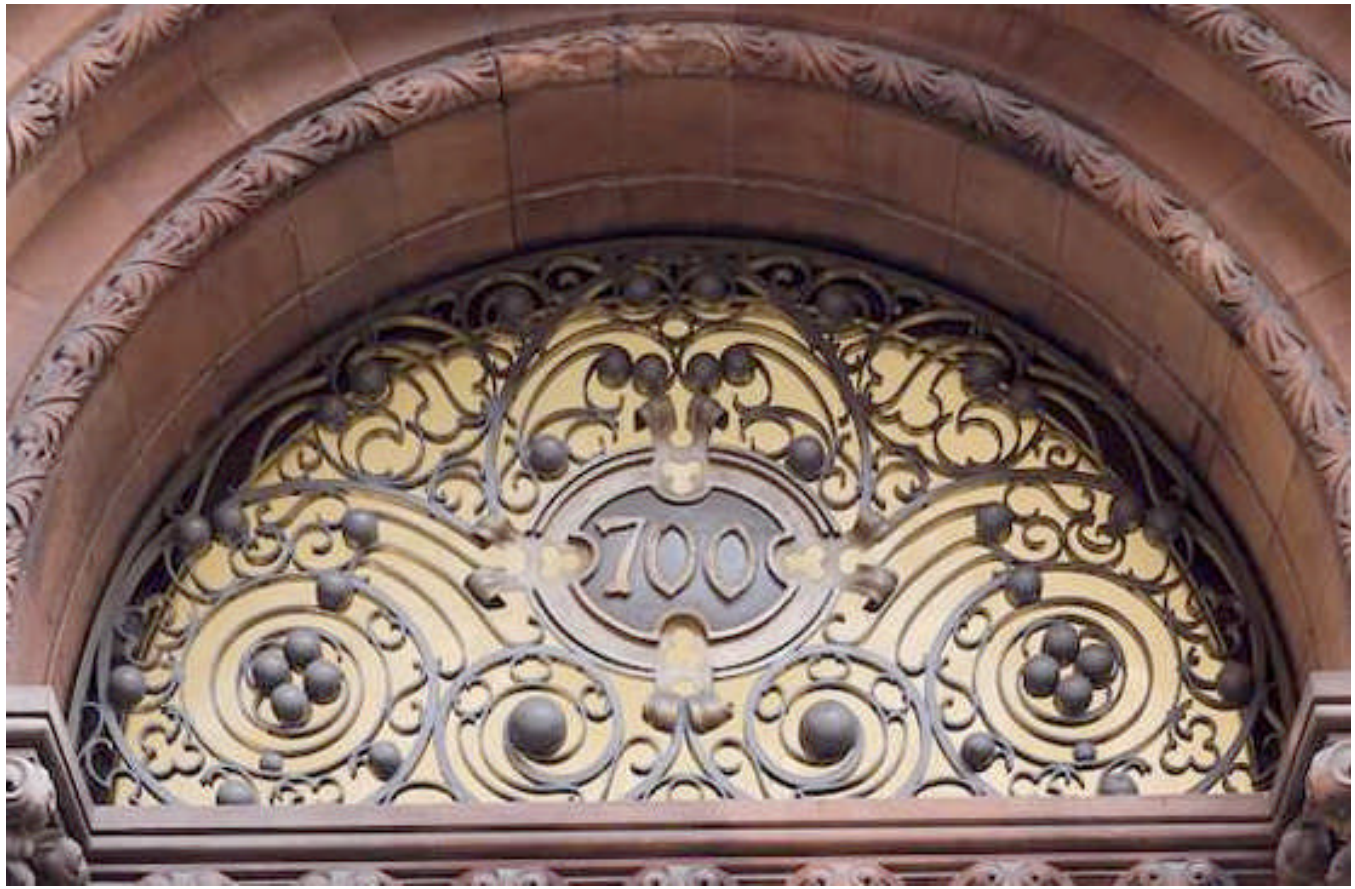
"…Broadway above Houston Street was a swank residential address by the 1830's…The business invasion started in the 1840's; an 1851 directory lists Charles Hiffert, a pianist, and E.M. Thurston, a whip manufacturer, at 700 Broadway…Commerce of another sort soon settled on the block, as developers streamed in to replace the ancient houses with modern business structures. At No. 700, at the northeast corner of Fourth Street, what is now called Audubon House was designed for the Schermerhorn estate in 1890 by George B. Post. It is a cozy round-arched Romanesque design of sandstone and brick. It should be lovable, but a 1990's restoration by the Audubon Society - although a textbook preservation project - seems to have suburbanized it, with milky reflective windows and carefully homogenized ground-floor signage. By comparison, photographs circa 1911 show almost every floor covered with a wild yell of signboards, banners and other advertising for dolls, china, cloaks, undergarments and other goods…"

***The New York Times,* September 26th 2004**


FRENCH CONNECTION
ALDO

"700 Broadway, the longtime headquarters of the National Audubon Society, has been acquired by Dallas-based Lincoln Property Co. The 8-story, 100,000 square foot building is situated on the northeast corner of Broadway and 4th Street in Greenwich Village. It was an abandoned property when it was purchased by the National Audubon Society in 1989. The not-for-profit conservation organization renovated the facility and made it a model of green office technology…Audubon's sale of the building follows a decline in the number of staff based at the organization's headquarters, driven by a strategic decision to decentralize operations and increase its presence at conservation-focused field offices nationwide. With less need for space and a big gain on its real estate investment, Audubon saw a big opportunity to advance its work…The organization plans to honor its long history by keeping Audubon's headquarters in New York City. It will lease a new facility. Once a location is selected, Audubon will once again seek to demonstrate leadership in the use of green office technology."

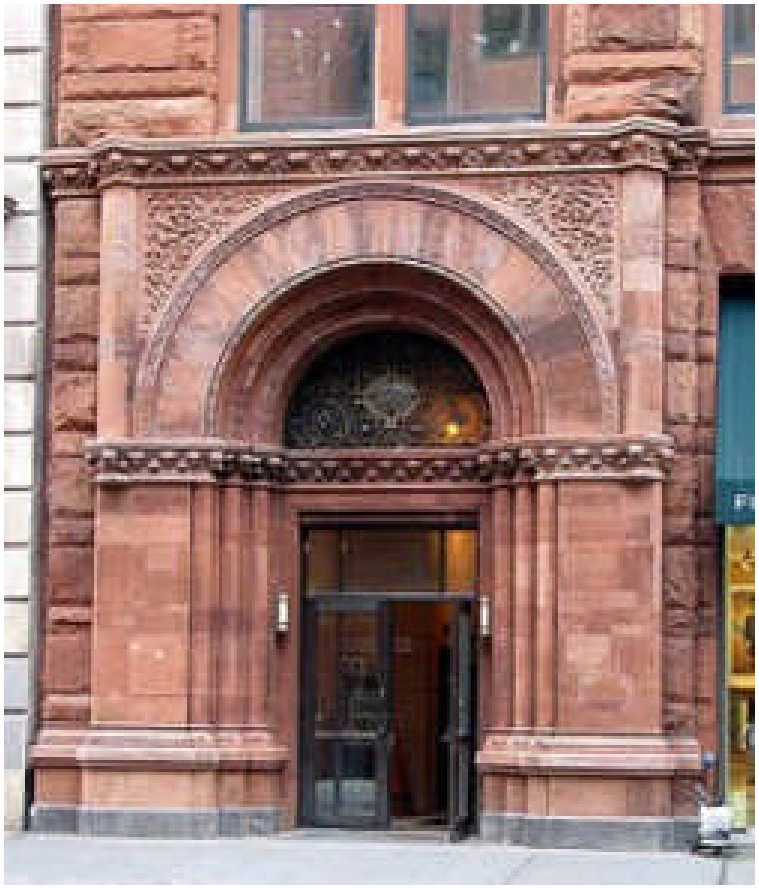
***National Audubon Society,* December 7th 2006**


700

Facade Restoration

"When a simple facade cleaning and repair project turned into an extensive deconstruction and restoration, the building owners and architect Philip Toscano turned to engineer Brian E. Flynn, P.E., and Seaboard Weatherproofing & Restoration to assist in restoring the historic building. The facade was found to have extensive structural and surface damage caused by years of freeze-and-thaw cycles and constant vibrations from the nearby subway line. As work progressed, the project was complicated by structural damage that was more extensive than initially anticipated…"

Seaboard Weatherproofing & Restoration



"…The wall was 32-inches thick and had large arched window openings encased with ornate terra-cotta stones. An additional 100 linear-feet of wall required removal of the terra-cotta fascia and the face brick. This not only required Seaboard to repair and re-sculpt 900 terra-cotta pieces, but also to patch brownstone, replace deteriorated terra-cotta balustrades, install metal flashing and a liquid membrane on the cornice at roof level, and restore the sandstone entranceway…"

Seaboard Weatherproofing & Restoration

Left: restored entranceway at 700 Broadway

<u>Top Left</u>: caption: "A craftsman repairs terra-cotta sculptures"

<u>Top Right</u>: caption: "Sculptures restored at 700 Broadway"

<u>Left</u>: caption: "Work in progress at 700 Broadway"

"…Pipe scaffolding and sidewalk protection maintained pedestrian safety throughout the project. The pipe scaffold at the upper floor and the roof were completely enclosed and 'winterized' so that work could continue on the massive brick walls through the winter months. Delicate repairs to the terra-cotta sculptures were done in heated interior spaces. The project team worked closely with the New York Landmarks Conservancy to ensure historic accuracy and comply with the building inspection requirements of New York City Local Law 11…"

Seaboard Weatherproofing & Restoration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"…Approximately 900 pieces of terra-cotta were tagged, removed, catalogued, organized, cleaned, and repaired mostly in the basement of the building. They then were reinstalled in their original locations on the building's two street front facades. Several hundred additional pieces were repaired in place. Terra-cotta bricks were salvaged wherever possible and new glazed bricks were ordered to best match the color, shape, and size of the old bricks…"

Seaboard Weatherproofing & Restoration

Left: caption: "Heads and other terra-cotta pieces that had to be tagged, removed, catalogued, organized, cleaned, repaired and sequenced for resetting"

Right: caption: "Measuring the proper distance between each head"

"…Throughout the project, we had to create new solutions…Our years of restoration experience came into play as we worked to restore 700 Broadway to its former glory."

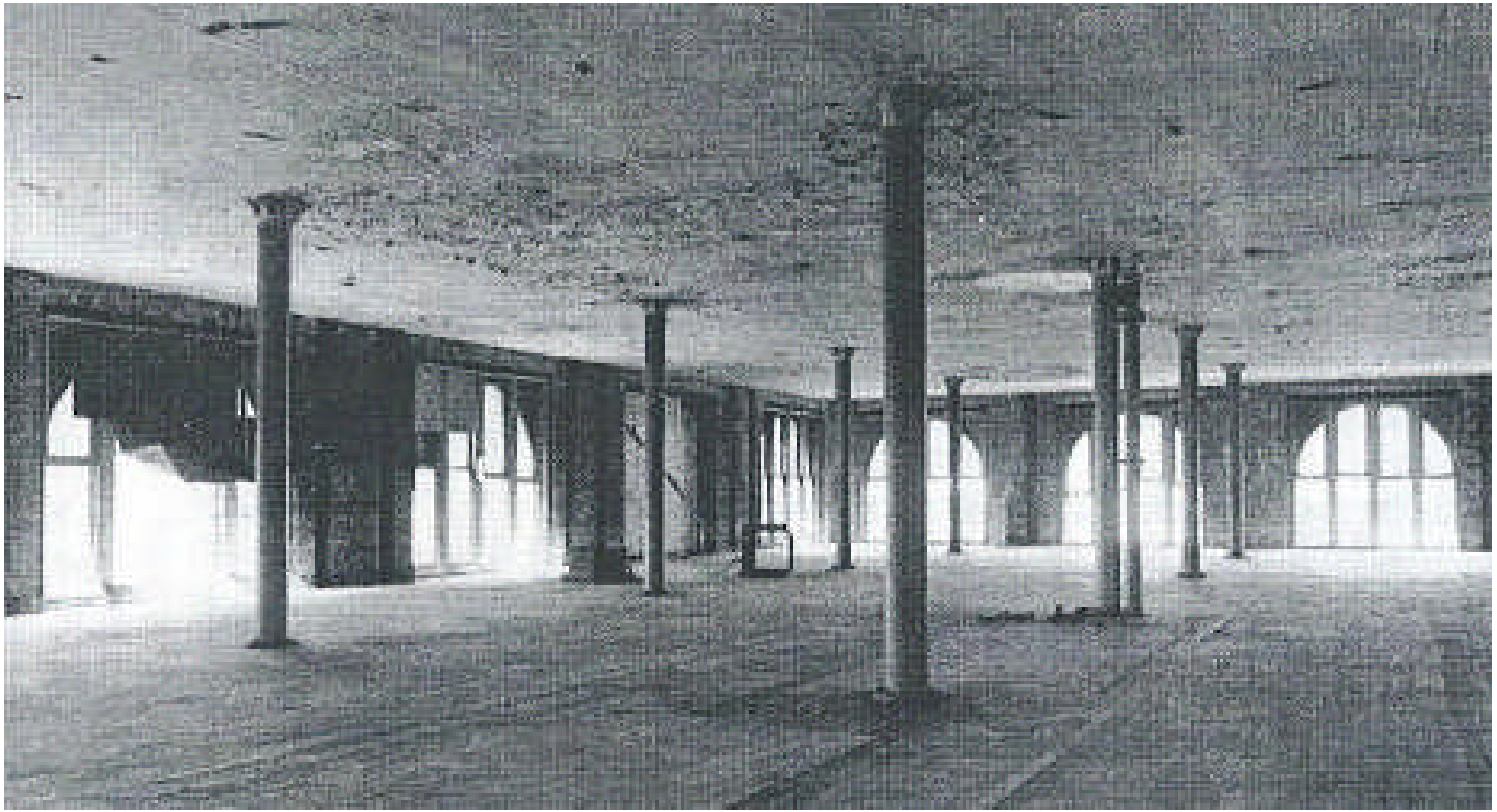
Seaboard Weatherproofing & Restoration

<u>Left</u>: caption: "Exterior detail showing capital on window pilaster. The carved series of grotesque faces along the cornice line can be seen at the top of the photograph."

The Integrated Approach

"In searching for professionals to work on Audubon House, we used several guidelines. Each team member was expected to have a broad understanding of and commitment to environmental and energy issues; a basic grasp of manufacturing processes; the ability and commitment to conduct research; and above all a willingness to work in an integrated fashion with other team members. In particular, we looked for an architect who could conceptualize beyond the material design – a viewpoint not trapped by the purely aesthetic."

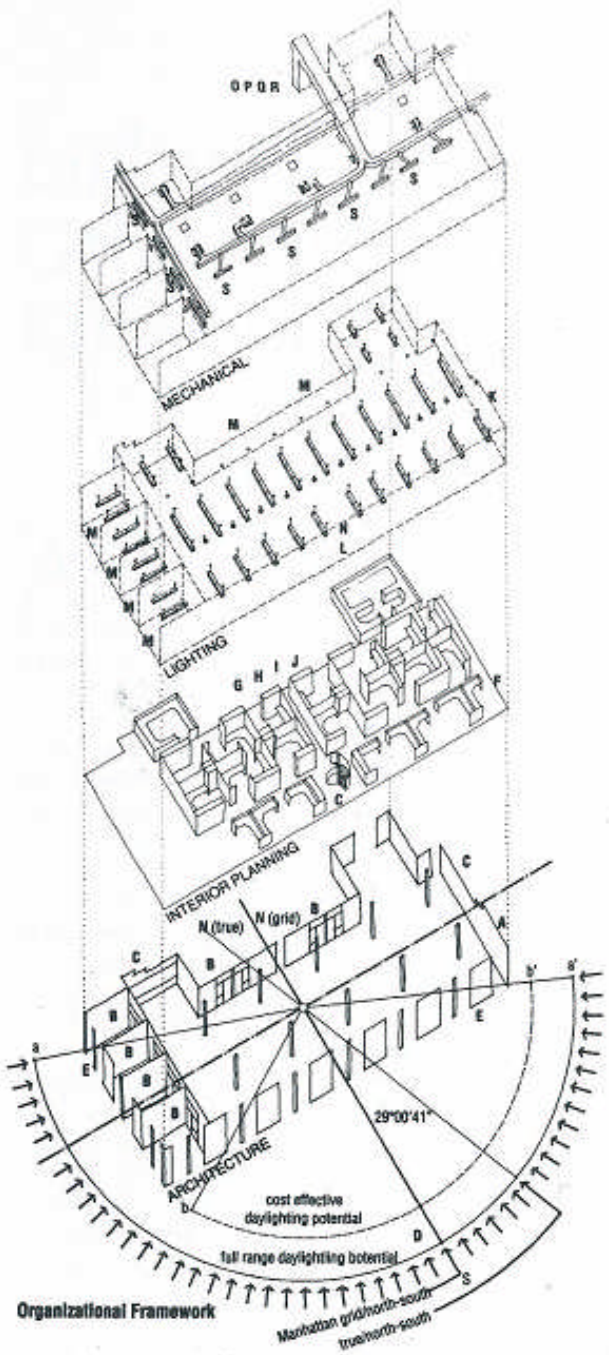
Peter A.A. Berle, **NAS President**



<u>Above</u>: caption: "Audubon House, sixth floor at start of renovation. By purchasing and renovating an entire office building, Audubon and its architectural team were able to incorporate environmental goals in an integrated fashion and in every aspect of the building process."

"…Because the architects, engineers, and other design professionals worked as a team, they were able to break loose from predictable design patterns and come up with imaginative solutions. Lighting experts talked with builders about positioning walls and windows. Chemists talked with furnishing suppliers to minimize chemical out-gassing. Air quality experts talked to architects about installing air intakes on the roof instead of at street level. A full-time researcher investigated new and old technologies for designers to consider. With all this input, the process took longer, but 'all these things have a payback and a financial benefit for the client,' said Lauren Reiter, Croxton's project architect…"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993. The story of *Audubon House* was a partnership of dozens of design/construction professionals who shared a vision for the future of urban architecture. Their non-hierarchal "team approach" (willingness to listen to the ideas/concerns of all parties concerned in the design/construction process) is commonly referred to today as "Integrated Design."



Mechanical Components

- **O** High efficiency gas-fired absorption heater/chiller serves air handler at each floor.
- **P** Separate, mandated outside air system delivers 24 cfm per person.
- **Q** Number of air changes (recirculated and filtered air) is 6.2 per hour.
- **R** Moisture carry-through in system is minimized by low velocity (less than 500 fpm) as well as cooling coil configuration.
- **S** Variable volume units at each perimeter office assure individual control and their arrangement in open office assures full "mixing" of air.

Lighting Components

- **K** Daylighting photocell controls outer bay of lighting (full range dimming)
- **L** All lighting is high efficiency, high color rendition fluorescent with electronic ballast (one ballast for two fixtures).
- **M** Sensors at offices, conference room, etc., turn off lights when room is unoccupied (zone sensors for open area).
- **N** Pendant arrangement of single tube fixtures with up/down components achieves 30 fc ambient light level with low glare characteristics overall.

Interior Planning Components

- **F** Perimeter work stations are held to 3 ft. 6 in. to maximize daylight to interior.
- **G** Open office area is organized east/west to take maximum advantage of daylighting.
- **H** Colors for systems furniture and interior surfaces are in high reflectance range to maximize both natural and artificial light.
- **I** Task lighting is incorporated as part of high efficiency task/ambient system.
- **J** All work stations meet test method and criteria for offgassing of formaldehyde, volatile organic compounds, particulates, etc.

Architectural Components

- **A** Full-height ceiling maintained at building perimeter to maximize daylight effect.
- **B** Enclosed office grouped north and west with clerestory glass.
- **C** Core elements (elevators, fire stairs, pantry and mechanical rooms) on north and east solid exterior walls.
- **D** High thermal performance windows with high transmissivity of natural light.
- **E** Exterior wall thermal upgrade (insulation) approximately three times code requirement (applies to all exterior walls)

Left: caption: " Audubon House, schematic diagram showing integrated environmental approach. The integrated approach is based on coordinated planning of architectural, interior design, lighting, and mechanical engineering components of the building in order to produce the desired environmental and energy-efficient results."

The Future is Now

"The grandeur and rich history of the urban environment are written in its architecture. Unfortunately these qualities are fast disappearing in favor of cookie-cutter skyscrapers. By choosing to renovate this building we were able to preserve a piece of New York history, as well as to achieve our environmental goals."

***Peter A.A. Berle,* NAS President**

RE: in 1988, the need to relocate the headquarters of the NAS presented a singular opportunity. In the wake of skyrocketing rents in midtown-Manhattan (NAS had been leasing office space for +$1 million annually), unhealthy working conditions and a rapidly expanding organization, NAS President *Peter A.A. Berle* made a decision that would profoundly affect the NAS, its own work environment and the future of *Sustainable Design and Construction*. In 1989, the purchase of an abandoned building made sense for multiple reasons. The building had been vacant for a decade and its $10 million purchase price reflected little more than the cost of the lot itself. The NAS was also saving a part of NYC's cultural heritage by preserving a century-old architectural gem. During the next two years, the interior was transformed into a model of an energy-efficient, environmentally responsible workplace while the exterior was completely restored to celebrate its original turn-of-the-century grandeur.

Overarching Concerns

"There are three broad overarching dimensions of value that drive the Audubon project: resource sustainability, environmental consequence, and the humanistic response. From these we derive the subsets related to recycling, energy efficiency, indoor air quality, pollution reduction, etc. No matter what the unique local characteristics of a project are – for instance the climate, utility fuel mix, geology, watershed – keeping these overarching concerns in mind will help the architect in any setting begin to organize priorities and come to the appropriate solutions for that site."

Randolph R. Croxton, **Principal, Croxton Collaborative**

Key Statistics

"…The work cost $142 per square foot, compared to the $120 to $130 a square foot to renovate a typical Manhattan office building using conventional technology, according to Croxton. Audubon hopes to save $100,000 a year in energy costs by using 60 percent less energy than a conventional building of similar size – 98,000 square feet. CFCs have been virtually eliminated, and greenhouse and acid-rain gases are expected to be cut by 60-80 percent…"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993. The *Schermerhorn Building* was purchased by the NAS in 1989 for $10 million. The restoration began in 1990 and was completed in 1992 at a cost of $14 million. It was dedicated in a ceremony on December 3rd 1992. The project was made possible by the generous support of more than 15K NAS donors nationwide.

"…Here is a partial list of the innovations at Audubon House:

• **Separate chutes** on every floor carry plastic, glass, aluminum, organic material, and different types of paper to a recycling center in the building's sub-basement. In the future, the in-house compost will nourish a rooftop conservatory. Audubon's goal is to recycle 79 percent of all products coming into the building, including 42 tons of paper a year. Audubon also wants 80 percent of all the products it purchases to contain recycled content.

• **Countertops** are made of recycled plastic, ceramic floors from recycled glass, drywall from recycled newsprint, insulation from a component of sea water, and wood from non-endangered sources.

• **Air is conditioned** with a high-efficiency, gas-burning heater/chiller; faucets conserve water; pumps, fans, and motors are 'smart'; windows are thermal resistant; and internal stairwells discourage unnecessary elevator use.

• **To help prevent** sick-building syndrome, indoor air is changed 6.2 times an hour (six times New York's standard); wall coverings and furniture give off few or no chemicals; un-dyed wool carpets contain neither formaldehyde nor CFCs; carpet padding is made entirely of recycled paper; and 80 percent of the particulates are filtered from the air.

• **Lighting energy** is saved by using high-efficiency fluorescents, clerestory windows, motion sensors, pendant light fixtures, low work-station walls, a skylight, an east-west office design, compact-fluorescent task lights, full-range dimming linked to the amount of daylight and highly reflective surfaces. Filing cabinets are positioned near windows…"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993

• Audubon House was designed to use 62% less energy than a "conventional" New York City code-compliant office building. Its energy-efficient features - from the thermal shell to the lighting reductions - were designed to save the NAS an estimated $100K each year, thus reducing the NAS's energy costs by 64%;

• Green architecture is affordable. The basic renovation and design costs of Audubon House were completed at a cost of $122 per square-foot - well within the market rate for projects of comparable location, size, and time (which average $120-128 per square-foot);

• Where conventional office buildings use 2.4 watts of electricity per square foot of lighting, Audubon House was designed to reduce that figure to 0.6-0.7;

• Audubon House uses no CFCs, chlorofluorocarbons, which contribute to ozone loss - in its cooling or insulation;

• Audubon's gas-fired chiller-heater emits no sulfur dioxide and 60% less nitrogen oxides than would result from the use of a conventional unit (both gases contribute to acid rain);

• Audubon's in-house recycling system is designed to capture up to 80% of our office refuse (mostly paper);

• Natural and recycled materials were used widely in renovating and furnishing Audubon House. Rugs and padding, wood and fabric, tiles and countertops were all selected to minimize off-gassing and combined with a high efficiency ventilation system, make Audubon House an exceptionally healthy indoor environment, and;

• By recycling an existing structure, the NAS saved not only the existing resources of the Schermerhorn Building, part of New York City's historic urban fabric.

National Audubon Society

Energy Efficiency

• Large windows on Southern and Western exposures and a central reception area skylight permit large quantities of natural daylight to flood workspaces;
• Pale furnishings and interior surfaces enhance "reflectance" of natural light;
• Clerestory windows in perimeter offices ensure that walls or corridors do not block daylight, so even the most interior workstations are illuminated by natural light;
• By placing ducts, pipes, and interior wiring toward the interior of the office space, it was possible to raise the ceiling near windows, allowing for still more light penetration;
• A "Task/Ambient" lighting system bathes offices in soft background light while task lighting can provide focused light where needed;
• Window blinds are stippled with pin-sized perforations, resulting in diffuse, soft lighting in exterior office spaces;
• T-8 Triphosphor fluorescent lamps provide high-efficiency, natural-tone light without emitting heat;
• Pendant ceiling fixtures give light near 360-degree dispersion and reflect 88% of light;
• Daylight dimming sensors (southern exposure only) dim light levels in inverse proportion to incoming daylight, and;
• Occupancy sensors throughout working spaces automatically turn off lights in unoccupied zones.

National Audubon Society

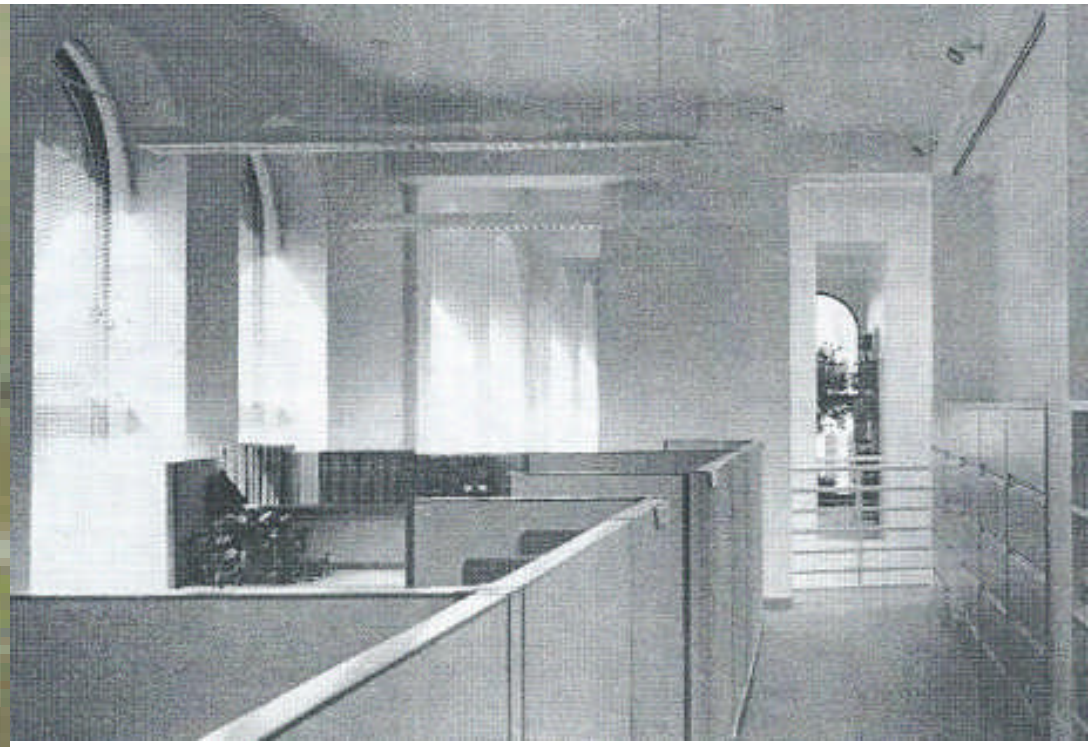
"The perforated venetian blinds installed at Audubon House are a perfect example of an aesthetically pleasing and ingenious energy-saving technology; simply by having tiny perforations in the slats, these blinds create the option to block out the sun's direct beam light, while letting in a diffuse light, rather than reflecting all the sunlight back outside. When the blinds are closed, it is possible to still see the outline of the cityscape outside."

Kirsten Childs, **Director of Interior Design, Croxton Collaborative**

<u>Left</u>: caption: "Interior, typical window with venetian blinds. These unique blinds have tiny pinholes in the slats that allow diffuse light to penetrate. DOE-2 software indicated that the energy savings would justify the premium cost."

DOE-2

“DOE-2” (developed by the *U.S. Department of Energy* and the *Electric Power Research institute of California*) – a computer software program that provides highly accurate estimates of energy needs and usage by simulating real-life conditions, was employed by the AH team to substantiate the initial estimates of the building’s energy usage and to help integrate add-ons into the building’s design and systems. The AH team used it mainly to demonstrate how cost-effective, energy-saving design could perform far beyond code.



<u>Above & Left</u>: caption: “Eighth-floor interior, looking west along the southern exposure. Abundant natural daylight floods the interior from the southern and western exposures, dramatically reducing the need for electrical lighting. Use of DOE-2 computer software helped confirm the energy savings to be gained from ‘daylighting’ the interior.”

Environmental Impacts

"The biggest problem is that we architects have been using too narrow a balance sheet to evaluate our decisions. That sheet is not complete; it doesn't include total efficiency and environmental costs. A building may be cheap and pretty, but will it go on to become an environmental and financial burden to those who occupy and maintain it?"

***Randolph R. Croxton,* Principal, Croxton Collaborative**

• The gas-fired absorption heater-chiller uses no CFCs, emits no sulfur dioxide and 60% less nitrogen oxides than do conventional units;

• "Economizer" cycle can replace the use of the chiller-heater during moderate seasonal temperatures, further reducing energy consumption and resulting pollution, and;

• Use of an on-site energy source, gas, for cooling reduces electricity needs during peak summer demand, thereby diminishing pressure on the local utility to seek new sources of hydro-energy in wilderness areas in Canada.

National Audubon Society

Resource Conservation

"…During the 20-month-long refurbishing project, all the demolition material that could be salvaged was sent off to recyclers. Concrete, masonry, wood, steel, iron, glass – even the scrap metal from the old boiler was hauled off; a small amount of the salvaged material was used on site. Many of the other building materials contain recycled material…"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993

“Simply by ‘recycling’ an existing building, Audubon saved 360 tons of steel, 9,000 tons of masonry and 560 tons of concrete (not to mention a building of great character and historical significance). Demolished materials from renovation, including scrap metal, wood, and masonry, were sent out for recycling. The recycled materials we used include:

- *Homasote subflooring, which is made from 50% recycled newsprint;*
- *Tiles made from 60% post-industrial recycled light bulbs (in the elevator foyers);*
- *Bathroom countertops made from recycled plastic containers, and;*
- *Drywall of partially recycled gypsum and recycled newsprint.*

At every workstation, employees are provided with special bins or folders for recycling. This feature is part of Audubon’s in-house recycling system, which includes four recycling chutes (currently used for white paper, mixed paper, and redeemable aluminum and plastic containers) that run throughout the building and lead to a sub-basement recycling room.”

Croxton Collaborative

"Resource conservation involves a cradle-to-cradle approach to building. Audubon House offered us the opportunity to reduce significant levels of consumption and waste in the built environment."

***Jan Beyea,* NAS Chief Scientist**

Low-Toxic and Natural Materials

"…Despite the Audubon House's revolutionary design, its principles are not hard to duplicate. All components are available off the shelf. 'We want this building not to be a solitary symbol of energy efficiency and indoor air quality,' Tom said. Audubon was interested in measures that others could replicate, he said. 'The building is, in effect, an educational tool'…"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993

- **Interior paints contain no VOCs (Volatile Organic Compounds);**
- **Wherever possible, furnishings avoid plywood, glues, PVC plastics, and other substances that emit formaldehyde and other VOCs;**
- **Carpeting is all natural, un-dyed, 100%wool; three breeds of sheep provided the three colors. The carpet under-layment consists of jute (plant fiber). Carpets were tacked down, avoiding the use of glue except on the stairs, and;**
- **Custom-made conference tables were made from certified, sustainably managed rainforest woods.**

National Audubon Society

HVAC

• The heater-chiller is located on the roof rather than the basement. Thus, the fresh air intake is located at the rooftop level, away from street fumes and exhaust vents;

• High-efficiency filter (ASHRAE 85%) immediately eliminates most particulates and dirt from the incoming air. Conventional filters remove approximately 35%;

• The fresh air ratio of 26cfm (cubic-feet per minute) per person greatly exceeds standards and guidelines (which range between 10 and 20cfm). This high rate of indoor air exchange (6x per hour compared to 1-2x per hour in conventional buildings) prevents build up of stale "air pockets";

• Air-handling units are located on each floor with additional filtering capacity. In many buildings, only one air-handling unit is installed for the entire structure;

• *Thermafuser* ceiling air outlets allow a high degree of targeted temperature control, and;

• The HVAC system cooling capacity is 180-tons; it uses lithium bromide instead of CFCs and its heating capacity is 1.7 million Btu/hour.

National Audubon Society

Role Model

"…Croxton designer Kirsten Childs said the building is 'performing as planned,' though she won't be able to back up that assessment with actual data until mid-November, the first anniversary of the building's re-opening.

RE: excerpt from *Designing a Sustainable Future*, Spring 1993

<u>Left</u>: Kirsten Childs, Director of Interior Design, Croxton Collaborative

"With over 500,000 members and more than 500 chapters throughout the Americas, the National Audubon Society is a leading grassroots organization working to protect and conserve the environment - from natural ecosystems to the urban landscape. Audubon House, headquarters of the Society, is a restored and remodeled century-old Romanesque Revival loft building in Manhattan. It reflects our national role by serving as a model for the energy-efficient, environmentally responsible workplace. Achieved at market rates with readily available technology, the renovation of Audubon House proves that environmentally conscious design can be both practical and affordable."

National Audubon Society

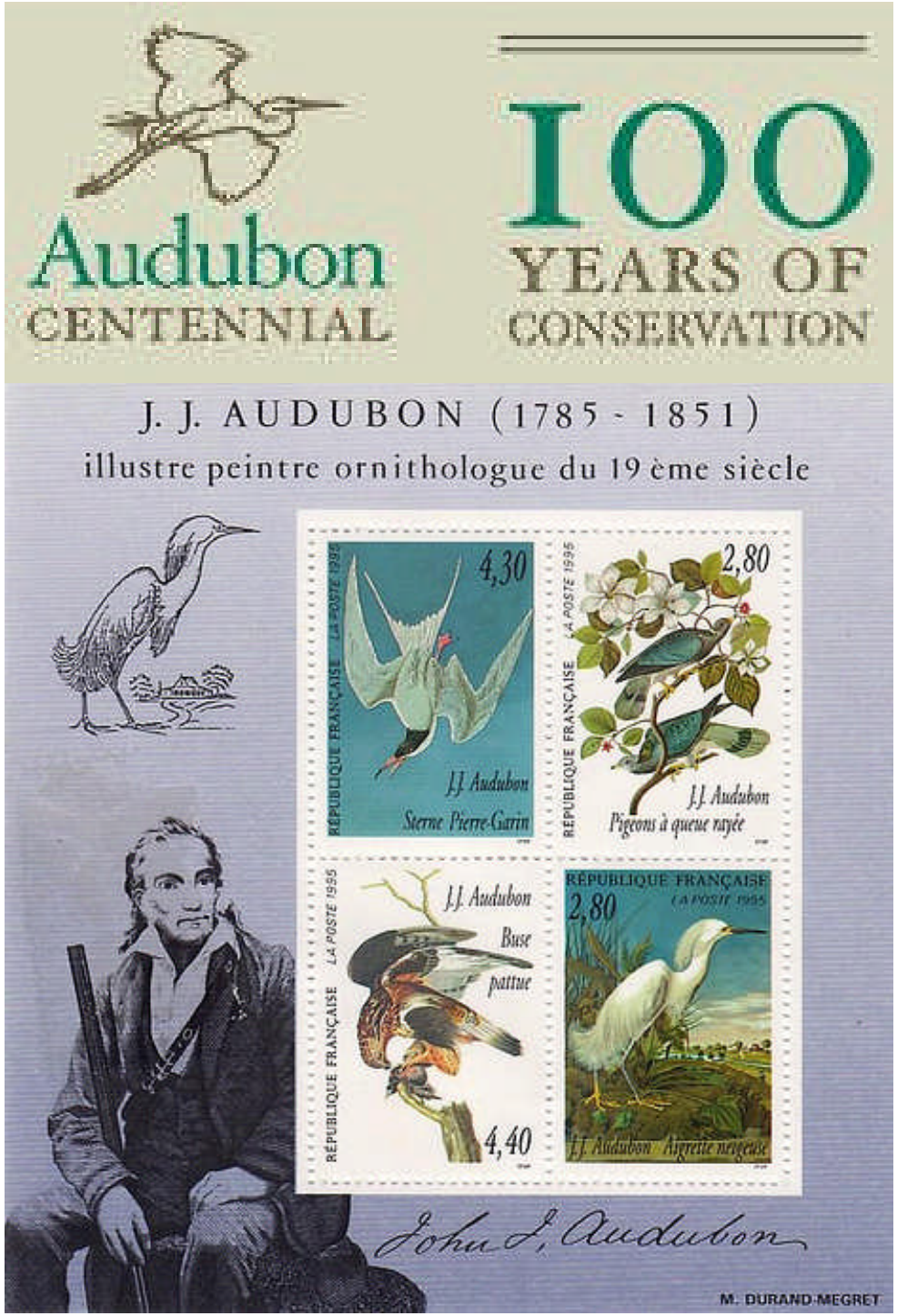
"We hope that Audubon House is not seen as an isolated example of a building created by environmentalists but as a vehicle for real change in the way building is practiced world-wide"

***Peter A.A. Berle,* NAS President**

For Biodiversity’s Sake

"The survival of the Earth's diverse ecosystems and the species that inhabit them, or 'biodiversity,' was the highest priority for Audubon. Ultimately, the steps taken at Audubon House to reduce environmental impacts and the consumption of energy and resources all comeback to the issue of bio-diversity."

***Jan Beyea,* NAS Chief Scientist**



"To conserve and restore natural eco-systems, focusing on birds and other wildlife for the benefit of humanity and the earth's biological diversity"

RE: NAS Mission Statement. For more than a century, the NAS has built a legacy of conservation success by mobilizing the strength of its network of members, chapters, Audubon centers, state offices and dedicated professional staff to connect people with nature and give them the power to protect it. A powerful combination of science, education and policy expertise combine in efforts ranging from protection and restoration of local habitats to the implementation of policies that safeguard birds, other wildlife and resources in the U.S. and across the Americas.

Successes include:

- **Protection of the *Arctic National Wildlife Refuge* (ANWR) and other fragile habitats;**
- **The ongoing recovery of the imperiled California condor and brown pelican;**
- **Adoption of innovative policies that balance habitat protection with green energy development on millions of acres, and;**
- **Continuing restoration of the Everglades and Long Island Sound.**

A Few Minor Adjustments

"…Despite a few minor adjustments – like walking the distance of a city block to get to copy machines located near recycling chutes – the building's design is fostering a more congenial work environment. Staffers talk face to face instead of over the phone. Offices have glass walls. 'The open work area to a certain extent breaks down the imagined walls and inhibitions people have,' Tom said…"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993

"We were always sick in the old building, and by three in the afternoon we were dragging and had to get coffee. Here we don't have to do that. The lighting is better, for one thing. The recycling is working out very well, too. At first, we had to get used to separating envelopes and paper. Now it's second nature. You just do it automatically."

***Cathy Lynch,* NAS Mailroom Supervisor**

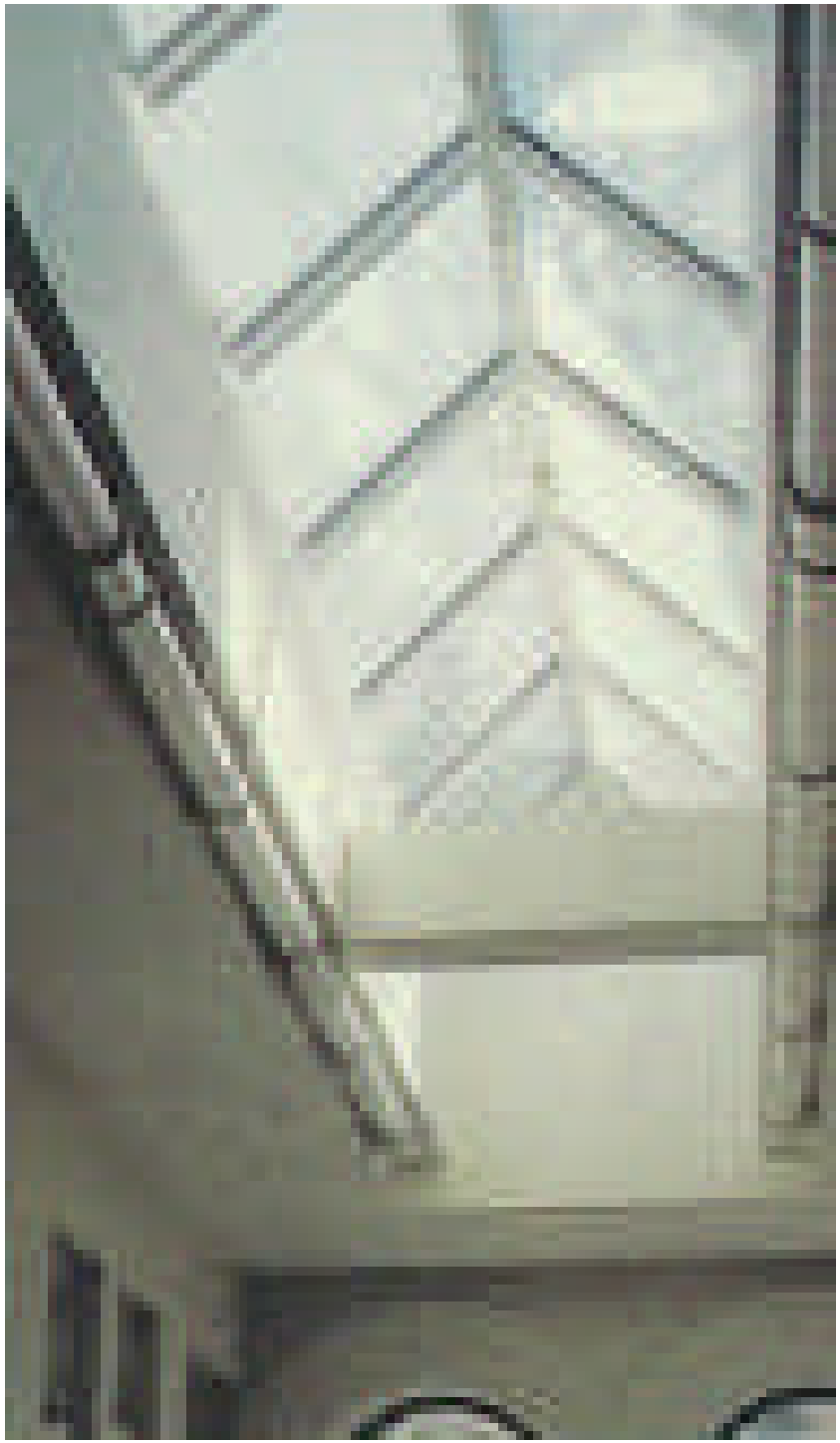
"…But workers are already giving the building high marks. 'There's always daylight flooding into your office,' Dave McGowan said. 'The layout is very open'…"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993

<u>Above & Left</u>: caption: "Main Reception Lobby, eighth floor. The skylight not only creates a light-filled space but also emphasizes the abundance of natural light and marks the natural rhythms of the day, themes that are central to the building project as a whole."

"It's been great here from the first day. There was no chemical smell in the carpet. The ventilation system has been great. I think this is the first time in my work life that I've been totally comfortable for a whole winter. I don't feel tired or have a headache at the end of the day, and I don't need to take a deep sigh of relief when I get into the street. As for the recycling system, I think it's time we 'walked the talk.' In this building, it's possible to do so."

***Wayne Mones*, NAS Director of Planned Giving**



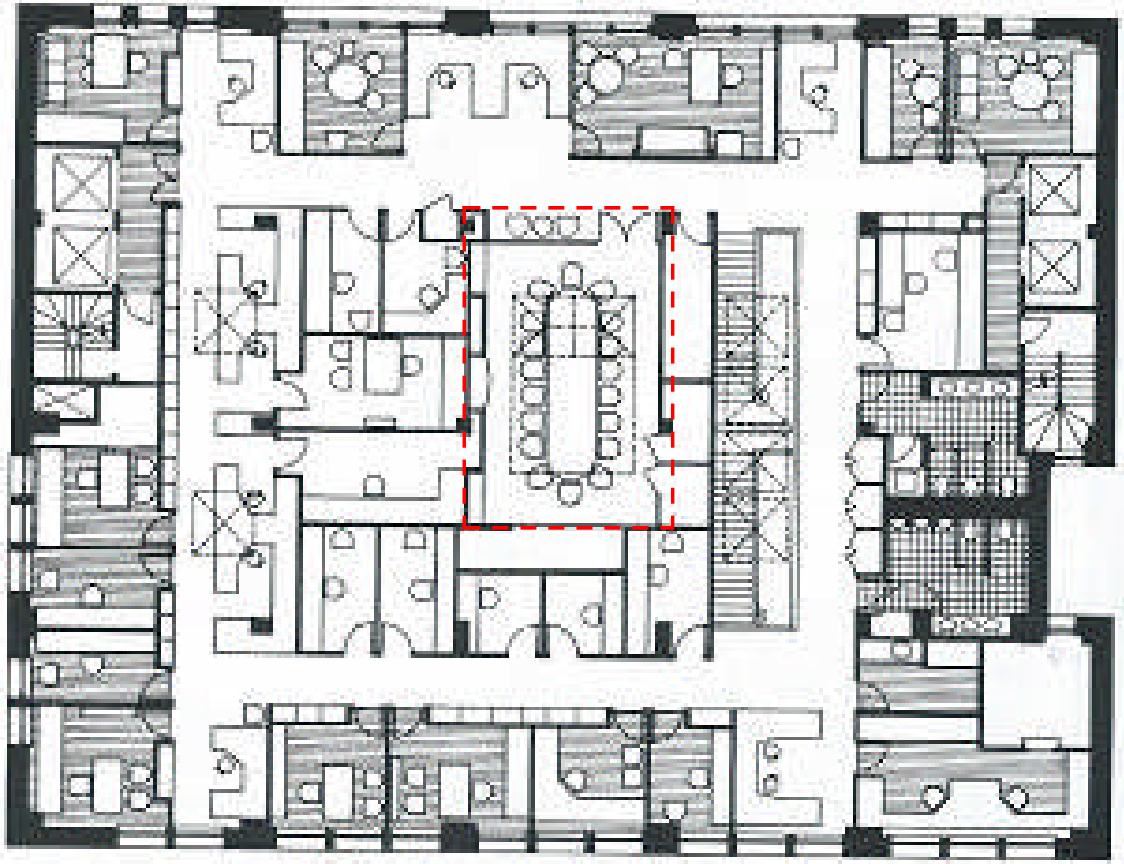
"I like the building so much that I give tours. It's very sunny, very visually appealing. I like working in an open area rather than an enclosed space. I like how accessible people are here."

Elizabeth Hax, **Executive Secretary, NAS Membership Dept.**

Embracing the Philosophy

"…Interest in the building has just been 'staggering,' Kirsten says. Croxton, which previously applied similar though less extensive improvements to the National Resources Defense Council's New York City headquarters, has plans for other projects that embrace the same philosophy. 'There is a built-in resistance to doing work this way. It takes more time and more effort,' Randall Croxton, the firm's chief architect, was quoted recently as saying. 'But anyone could go out tomorrow morning and use the technology we have.'"

RE: excerpt from *Designing a Sustainable Future*, Spring 1993



"…Twenty six years ago, Croxton helped define sustainable architecture when the firm completed two and half floors for the NRDC in a 12-story, early-20th-century building. The design featured elements such as an emphasis on daylight and the monitoring of energy use…"

***GreenSource*, September 2014**

<u>Left</u>: caption: "Typical floor plan, Natural Resources Defense Council. Many of the methods used at NRDC were adapted or built upon at Audubon House, such as the 'daylighting' of the interior with open plans and the installation of clerestory windows in the perimeter offices."

NATURAL RESOURCES DEFENSE COUNCIL

"In 1988, NRDC began renovating a former light industrial loft space in New York City's Flatiron district to house our main office. The goal was to put our environmental principles into practice by designing an office that would dramatically cut down on our energy use, while at the same time demonstrating to architects, builders, and businesses around the country (and as it has happened, the world) that 'green building' concepts can go hand in hand with pleasant, productive, professional workspaces. In 1989 vision became reality and NRDC's New York staff moved into a bright, airy new home…"

NRDC

"…When we began our New York office project, green design was a fledgling idea, largely untested in real-life settings. So while the NRDC chose an existing building for our New York office, the project broke new ground. But in one aspect of the renovation we decided against innovation: to ensure that our office would be a model others could replicate, we insisted on using only materials and technologies already commercially available and cost-effective…"
NRDC

"…Major strides have been made in green design since NRDC's New York office opened, yet it remains a model of energy efficiency. The idea: let there be natural light. We chose our office space, the top three floors of a 12-story Art Deco building in a neighborhood with few skyscrapers, for its abundance of natural light. Using a combination of this free-flowing - and free-resource and energy-efficient technologies, we have cut our energy consumption by 70 percent compared to conventional offices…"

NRDC

"…Some of the energy-saving features of NRDC's New York office include:

• Ribbons of glass around private offices, open-ended hallways, and an open interior staircase all help distribute natural light, captured through skylights and windows;

• Highly efficient fluorescent tubes in specially designed polished aluminum fixtures are 40 percent more efficient than standard fluorescents;

• Occupancy sensors, which turn the lights off when a room is empty for six minutes, yield an additional 30-percent energy savings;

• Sandwiched within each double-paned window is a thin polymer film that admits visible light while repelling ultraviolet and infrared rays, keeping the office cooler in summer and warmer in winter;

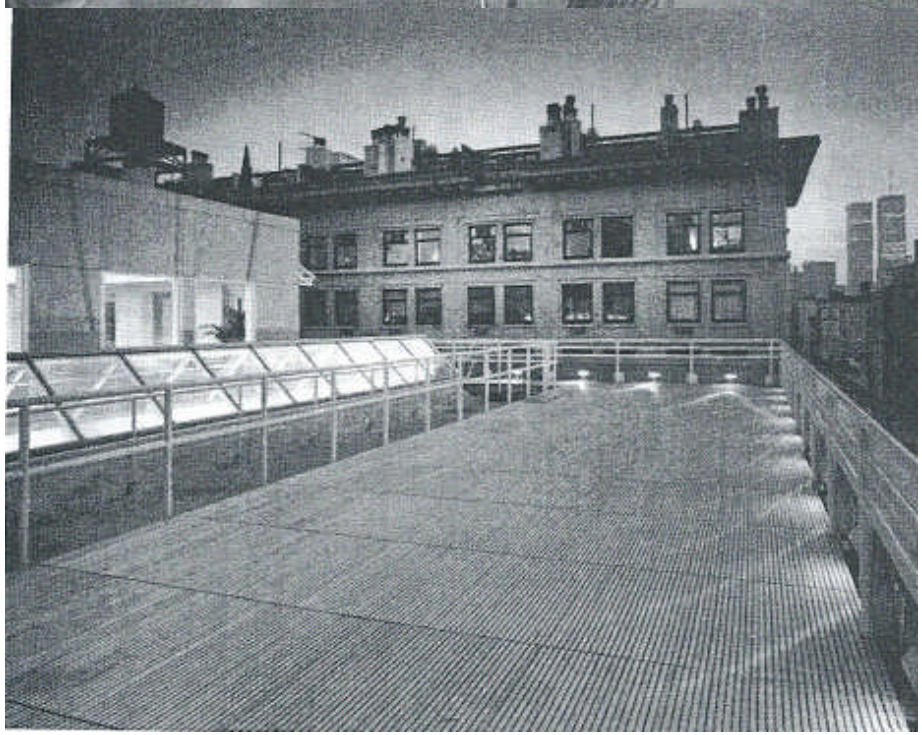
• Because NRDC's efficient electric lighting and thermal-paned windows reduce unwanted heat gain, our air-conditioning system is 30 percent smaller than for a conventional office.

NRDC's New York office won the Interiors Magazine award for environmental design in 1990. The office was designed by the Croxton Collaborative."

NRDC

Two Cultures

"The 'energy crisis' of the 1970s, coupled with the emergent environmental movement, produced two responses, or 'cultures,' in architecture. One, concerned mainly with reducing energy, utilized a high-technology approach to energy conservation; the other, concerned more with the widespread environmental impacts of development, used a low- or no-technology 'back to nature' approach. There was also a divide between energy conservation (which meant minimum fresh air) and improved indoor air quality (which required maximum fresh air and more energy). During the 1980s, common ground was established among these different points of view, illustrated in the 1988 redesign of the NRDC offices, where we were able to reconcile high levels of energy efficiency with high indoor air quality. In 1990, the American Institute of Architects, through the leadership of Bob Berkebile, merged the previously separate committees observing energy and indoor air quality, among others, to form the Committee on the Environment, which mirrors this 'holistic' perspective."
***Randolph R. Croxton,* Principal, Croxton Collaborative**



<u>Top</u>: caption: "President's office with open windows. The choice of operable windows provides a 'humanizing touch' to the workspace, allowing workers direct access to the outdoor environment and a degree of individualized 'climate control' on temperate days."

<u>Bottom</u>: caption: "Ninth floor: conference center, skylight and rooftop. Audubon commissioned construction of a ninth-floor conference center addition to the building. The conference center is available for use by other non-profit organizations and adds value to the project for Audubon. Audubon employees have access to the rooftop, which is to be enhanced with plantings."

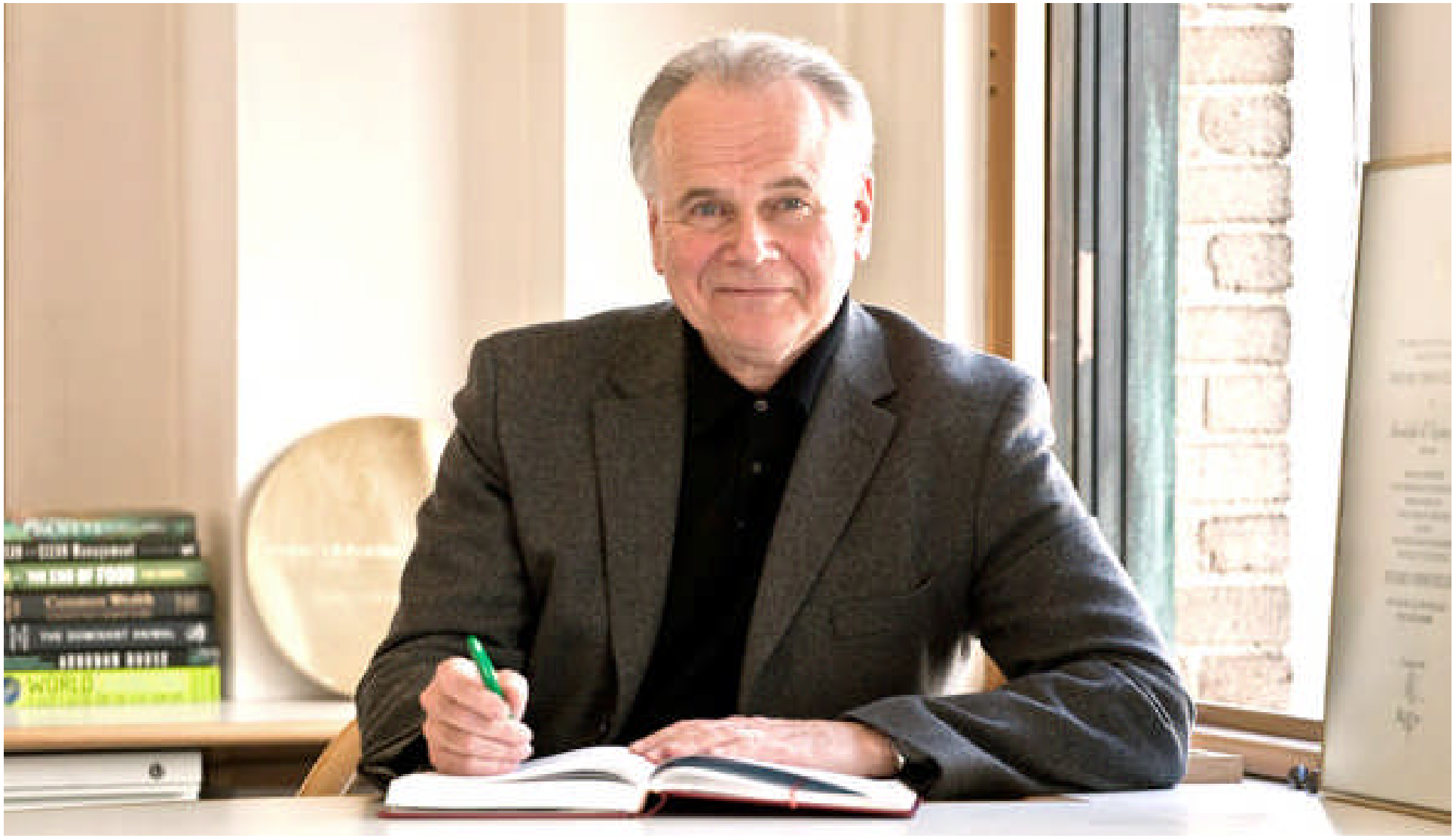
"Two decades ago, sustainability was a relatively unknown concept, and its precursor, 'environmentalism,' was not generally associated with cities or buildings. Environmentalism was about clean air and water, recycling, and saving endangered species or ecosystems; the environment was associated with agrarian values or pristine wilderness - anywhere but cities. If buildings were involved at all, they tended to be passive solar houses in rural settings. In the late 1980s and early 1990s, two ground-breaking New York City projects, designed by the Croxton Collaborative, started to transform this paradigm. Both projects - the Natural Resources Defense Council (NRDC) offices and the headquarters for the Audubon Society - were renovations of older buildings in Manhattan. They demonstrated that urban environments could be designed sustainably with green buildings, and that the concept of the 'environment' needed to incorporate populated landscapes, including the places of densest occupation and most massive impact: cities…"

NYC Mayor's Office of Sustainability

The Worst the Law Will Allow

"I did not like the old building. There was a perfume manufacturer on another floor and sometimes the odors coming through the air system were enough to drive you out of your office. The building did a lousy job of providing an even temperature in summer and winter. People constantly had heaters out in winter, and fans in summer. And between the stillness of the air and the flickering lights, by 4 p.m. every day I was dragging…"

***James Cunningham*, NAS CFO**



"Traditionally, the building industry has been dominated by an approach that is minimally code-compliant. This inherently results in buildings that are the worst the law will allow. At Audubon House we focused on highest cost justifiable performance. Code minimums were left far behind." 87

Randolph R. Croxton **(above), Principal, Croxton Collaborative**

Kick-Off

"The rebirth of the handsome 1890 George B. Post, Romanesque structure as Headquarters for the National Audubon Society in New York City, exemplifies a sustainable approach to the reuse of such turn-of-the century buildings. In the internationally renowned renovation of this building, completed in 1993, the work of Croxton Collaborative Architects yielded the highest integrated levels yet achieved for environmental/sustainable performance. Audubon House, with some 98,000 gross SF, required a complete gut and rehabilitation of the interior, along with preservation of key facade elements and conservation of the basic structure. It represents a breakthrough in the reuse of older buildings for new occupancies and established a leadership exemplar that engages the 'whole' building, including a massive thermal shell upgrade and completely new mechanical and lighting systems within the limited, rigidly imposed budget of a not-for-profit organization. As a result, the building used 64% less energy than code compliance required and annual savings exceeded $100,000.00 per year. This building kicked off the 'green' movement in architecture."
Croxton Collaborative

Stretching the Imagination

"…It's nice not to deal with those problems any more. At Audubon House I'm in the office at 8 a.m. And I stay until 7 p.m. And I still have a little energy at the end of the day. I think the air is so much better here, and there is greater productivity. Everyone is enthusiastic about what we've accomplished. When you invite friends here, they say, 'Wow, this place looks great!' Sometimes it just stretches their imagination."

***James Cunningham*, NAS CFO**

Part 2

A Model “Green Building”

Background and Context

"Although the concept of sustainable cities has gained acceptance as an ideal goal, few urban areas are approaching it. As an integral component of any urban area, buildings have a strong impact on both their immediate environment and the more global one, as well as on the people occupying them. To date, little attention has been paid to that impact. Buildings are enormous consumers of electricity. The people who live and work in buildings consume large amounts of material and produce large amounts of waste. Building materials are often toxic, causing damage to human health and to the outside environment…"

***The Mega-Cities Project* (ca. 1993)**

"…The way buildings are designed and constructed largely determines the level of their negative long-term environmental impacts. In recent years, the relationship between buildings and the environment has gained recognition and a number of building renovation and construction projects have included environmentally-beneficial measures. As a precursor to relocating and rebuilding their national headquarters, the National Audubon Society, one of the largest and most widely respected environmental organizations in the United States, recently began to place focus on the urban environment and particularly the effect buildings have on that environment. Specifically, they researched the energy consumption of buildings, the production and disposal of waste, and the overall effect buildings can have on the environment and human health…"

***The Mega-Cities Project* (ca. 1993)**

"…Office buildings currently account for a third of the United States' peak electricity demand and represent the largest demand for new energy, as cities grow and new office space is constructed. The Audubon estimates that office buildings and the power plants that supply them emit 740 million tons of carbon dioxide annually (14% of U.S. total CO2 emissions) and four million tons of sulfur and nitric oxides. If energy consumption continues at the same rate, some difficult decisions between the environment and increased consumption will have to be made. Construction of new power plants, burning more coal and oil, or pursuing nuclear energy will all have continued and heightened negative effects on the environment. Urban centers, with their dense concentration of office buildings, are the primary centers of this energy consumption. As such they also hold great potential for positive change in energy consumption patterns and environmental improvement…"

***The Mega-Cities Project* (ca. 1993)**

"…Waste related to buildings is generated both in one-time waste from office construction and renovation, and in the daily waste from office operations. During the construction or renovation of a building, an enormous amount of waste is produced in the form of concrete, metal, and wood. Typically, these materials are replaced by new materials which deplete natural resources. In addition, the service sector has gradually outstripped the manufacturing sector in most urban areas, which has led to an enormous daily stream of paper and other waste. The Audubon estimates that the average office worker disposes of 100 pounds of waste paper each year…"

***The Mega-Cities Project* (ca. 1993)**

"…Sick Building Syndrome (SBS) has gained widespread attention in recent years. The U.S. Environmental Protection Agency (EPA) estimates that this 'hidden' syndrome costs the U.S. economy $60 billion a year through worker illness and lost productivity. Many office workers experience sluggishness and respiratory problems which are symptoms of the syndrome, but which they take for granted as normal everyday occurrences. Yet buildings, particularly bacterial and fungi growth, and materials with toxic emissions such as volatile organic compounds (VOCs), may be causing such symptoms. Poor air circulation further compounds the negative effects. Many urban residents spend considerable time in an office, so the quality of the office environment has a definite impact on their physical and mental well-being…"

***The Mega-Cities Project* (ca. 1993)**

"…Finally, these specific problems with office buildings are compounded by another problem; the traditional approach of architects, designers, and construction firms many times is to disregard the natural environment. Buildings are not designed and built to be harmonious with the natural environment, and the surrounding context is treated as alien periphery. However, the expanding search for solutions to environmental problems has begun to reach those who design and construct buildings. There is a growing recognition that building plans can integrate environmental concerns and address some of the mentioned problems of energy consumption, waste disposal, and worker health…"

***The Mega-Cities Project* (ca. 1993)**

Project Description

"…After performing the necessary preliminary research, the National Audubon Society designed and constructed a new headquarters office, using environmentally safe materials, low energy use systems, and a building-wide recycling chute system. By attempting to achieve cost-efficiency and easy replicability, the main goal of the project was to serve as a 'green building' model which would encourage others to adopt similar building practices. The components of the 'green building' model were chosen to fulfill several objectives:

- ***reduce energy consumption;***
- ***save on operating expenses;***
- ***allow for aggressive office recycling;***
- ***mitigate worker illness, and;***
- ***benefit the global environment by leading to less greenhouse gas and ozone-depleting emissions…"***

***The Mega-Cities Project* (ca. 1993)**

"…In the past, the National Audubon Society's lobbying and activism efforts focused mainly on the protection of wildlife, such as the spotted owl of the Northwest, and its habitat, the ancient forests of the Northwest. A network of local Audubon chapters is spread throughout the country, which provides a voice for conservation on the community level. The Society has also participated in joint projects with environmental organizations on the international level…"

***The Mega-Cities Project* (ca. 1993)**

"…But although better known for their work on the natural environment, the Audubon Society recently became interested in the built environment. They had their headquarters in midtown Manhattan for over 100 years, but gradually outgrew the office space. Their need to relocate became a testing ground for their progression from wildlife protection into the protection of the urban environment…"

***The Mega-Cities Project* (ca. 1993)**

"…A search was first made for an appropriate site. The Audubon Society chose the Schermerhorn Building, located in lower Manhattan on Broadway at East 4th Street. It was opened in 1891 and designed by George B. Post, who is known for designing the New York Stock Exchange. The building's original use was as a department store, which had evolved into a garment sweat shop. It was abandoned in recent years except for street level retail use. Due to its poor condition, the Audubon was able to purchase the building for a relatively inexpensive $10 million, which allowed a majority of the total project cost to be dedicated towards renovation. The Society envisioned the shell of the building as the structural framework for a comprehensive renovation project. By starting from scratch, Audubon could 'build-in' a variety of environmentally beneficial components…"

***The Mega-Cities Project* (ca. 1993)**

"…A team of experts was compiled, consisting of internal staff, an architect, an interior designer, and a lighting consultant. This approach allowed the concerns of Audubon to be combined with the experience of the consultants who had previously retrofitted the headquarters of the Natural Resource Defense Council (another respected environmental non-profit organization based in New York City) with a highly energy-efficient lighting system. A significant amount of research was put into the product specifications. The in-depth profiling of environmentally-benign building materials was a learning experience for the team and provided a comprehensive view of the market for these types of products…"

***The Mega-Cities Project* (ca. 1993)**

"…The team established three criteria upon which they based their product selection decisions. First, the product had to be environmentally responsible. An in-depth search was conducted to identify building products - flooring, insulation, paint, rugs, etc. - with minimal side-effects and environmental 'profiles' assembled on each product. Second, the product had to be readily available in the marketplace in order to be a replicable model. Third, the purchase had to be cost-effective. This was perhaps the most critical criteria in terms of the transferability of the Audubon model. The team used a business-like, bottom-line approach that required a three to five year pay-back period on environmental measures, such as the super-efficient lights, which cost more than traditional lighting systems. This criterion also ensured that cost savings, such as lower electric bills, would continue to occur after the pay-back period…"

***The Mega-Cities Project* (ca. 1993)**

"…After performing the product research, the critical decisions were made and an overall plan carried out. The leading measure in fighting the energy consumption problem was an extremely efficient lighting system. Lighting fixtures were placed only where needed and ambient (background) lighting was kept to a comfortable minimum. The combination of tall windows, skylights, and an open office design allows ample sunlight to flow through the building and provides a viable substitute for artificial lighting (which is used more on overcast days). Occupancy sensors were installed to insure that lights were in use only when they were needed, and daylight sensors were added to adjust lighting levels based on the amount of outside light permeating a room…"

***The Mega-Cities Project* (ca. 1993)**

"…The windows and walls were also vital components in the quest for energy efficiency, as it was important to address heating and cooling costs. Double-paned windows with 'heat mirror' sheets were installed throughout the building, and the walls were insulated at a level three times the applicable energy code. Audubon also opted for a gas-powered heating and cooling unit, which emits no chlorofluorocarbons (which contribute to ozone depletion) and minimal acid-rain ingredients. Solar energy was analyzed as a supplementary power source, but it did not meet the payback criteria. Audubon completed feasibility studies to determine where solar panels could be installed when the costs reach a more competitive level. The installed lighting system cost approximately $100,000 more than a conventional lighting system. However, this premium will be recouped quickly with projected annual energy savings of $40,000…"

***The Mega-Cities Project* (ca. 1993)**

"…The project team also addressed both aspects of the office waste problem - waste from the construction or renovation of an office and waste from daily operations. An initial decision was made to renovate the interior of the building, instead of reconstructing the entire structure. 'Recycling' the building would save 9,000 tons of masonry, 560 tons of concrete, and 300 tons of steel – and preserve the historic character of the structure. Audubon also helped to 'close the loop' by recycling as much demolition material as possible and using recycled post-consumer building materials. Because there is an expanding network of re-processors who accept demolition materials and suppliers who sell post-consumer materials, this approach was feasible and replicable…"

***The Mega-Cities Project* (ca. 1993)**

"…To handle the daily office waste of the Audubon workers a chute system was installed. Four internal chutes descend to the basement, with each devoted to a particular waste type. Special composting equipment handles the food waste, which is mulched into fertilizer for use in potted office plants and the rooftop garden. Other waste – newspapers, glass, and hazardous items – can be disposed in recycling bins located in kitchen areas on each floor. The chute system costs $185,000, which unfortunately has no pay-back potential at this point…"

***The Mega-Cities Project* (ca. 1993)**

"…Efforts were made to address Sick Building Syndrome by improving the air quality and circulation and by using non-toxic materials. The team designed and installed a circulation system with high-speed air flow (double the highest recommended standard), a high ratio of fresh outside air, and an 80% filtration rate for outside particulates (compared to a 30% industry average). This new system ensures a supply of breathable, high-quality air and prevents the build-up of bacteria and fungi, the organisms that infect a building. Non-toxic building materials were identified and used, sometimes in a creative fashion. The mix of products chosen by the team included both the use of traditional products for non-traditional uses and non-traditional products for traditional uses…"

***The Mega-Cities Project* (ca. 1993)**

"…Other actors have participated in making the project a success. Consolidated Edison (Con Ed) and Brooklyn Union Gas – the New York City energy utilities – were very interested in the undertaking. Con Ed provided a $72,000 rebate to offset a portion of the cost for the gas-powered heating/cooling unit due to its high efficiency. The utilities will keep an update on the energy savings from the Audubon building, as such solutions help achieve their goals of energy conservation as a financially sensible and environmentally beneficial alternative to supply expansion. Audubon has continued this partnership with the utilities, working with them to encourage performance rebates instead of one-time rebates…"

***The Mega-Cities Project* (ca. 1993)**

Obstacles

"…Given the innovative and experimental nature of the project, a number of obstacles were encountered in renovating the Audubon Headquarters. First, prior to undertaking the project, relatively little research had been conducted on ways to construct a 'green building' and products which can be used to do so. The Audubon overcame this obstacle by including extensive research as an initial step in the undertaking. However, continued research on the success of the headquarters experiment as well as on other environmentally sound products and alternatives will be needed to fully overcome this obstacle for future projects…"

***The Mega-Cities Project* (ca. 1993)**

"…The objective of cost-efficiency created a need for research, since the few products which have been designed for environmental purposes are often expensive. The Audubon was able to overcome this obstacle through more research and by adopting creative and innovative ways of using traditional yet non-toxic materials and products. Again, efforts to make the information available on cost-effective environmentally sound products, as well as to make such products accessible, will be necessary if this obstacle is to be overcome in encouraging the widespread construction of 'green buildings.' Finally, one of the greatest obstacles in achieving this larger goal is a traditional mindset which fails to recognize or address the negative impact a building may have on the environment. Extensive public education will be required to address this issue…"

***The Mega-Cities Project* (ca. 1993)**

Project Impact

"…Although the Audubon's larger goal of encouraging others to adopt similar 'green building' models has yet to be evaluated, the construction of the Audubon's headquarters is largely viewed as a success. For example, with the new energy system, the Audubon building now uses less than one watt of electricity per square foot, in comparison to the 2.8 watt average for typical offices. This clearly demonstrates the connection between energy efficiency and economic concerns and provides the global benefits of decreased greenhouse gas emissions…"

***The Mega-Cities Project* (ca. 1993)**

"…The chute system and other recycling efforts are operating effectively and efficiently. The Audubon estimates that this effort will lead to an 80 percent recycling rate and will annually conserve 42 tons of paper. Although the measure was enacted at a loss for the Audubon, at a larger level it is helping to save resources and improve the environment. In terms of the health of workers and Sick Building Syndrome, the Audubon staff has reported feeling fresher. One staff member remarked that proof of this 'freshness' came after a long budget meeting – a time normally characterized by lethargy and exhaustion - when the staff member felt active and alive…"

***The Mega-Cities Project* (ca. 1993)**

Scaling Up the Impact

"…The 'green building' project has only begun at Audubon. While the renovation has been completed, the challenge of spreading the word and getting the building accepted as a model for the future still lies ahead. A number of initiatives have been undertaken as a means to meet the goal of replicability. A video documenting the project is available and a technical manual targeted at architects, engineers, and other decision-makers in the field will soon be released. This manual will describe the decisions and materials which went into the project, and Audubon hopes it will serve as a baseline guide for similar projects. Audubon also has been working with government officials on two fronts: integrating cost criteria into the bidding process to encourage 'green building' measures, and changing local building codes to mandate some of the measures used in the Audubon renovation…"

***The Mega-Cities Project* (ca. 1993)**

"…The fact that the building successfully combines environmental measures with economic concerns makes it a transferable model. However, a number of pre-conditions must be met in order to 'green' a building. Owners, as well as architects, designers, and builders must be willing to consider these measures and accept a more comprehensive view of a building. They also must be willing to experiment to some extent with new methods and products. To be truly environmentally conscious, they may even have to be willing to experience some financial losses…"

***The Mega-Cities Project* (ca. 1993)**

"…Those interested in promoting these measures, such as environmental groups, public utilities, or governments, must also continue to encourage 'green building' projects and create incentives. Information regarding the way such projects can be undertaken must be easily available and spread to necessary parties. With the progress of experiments like the Audubon's Headquarters, information must be consistently updated as it becomes available. Efforts must be made to make environmentally safe products both available and affordable. Finally, if necessary, both financial incentives and governmental mandates should be put in place to encourage the use of environmentally sound products and the construction of 'green buildings.'"

***The Mega-Cities Project* (ca. 1993)**

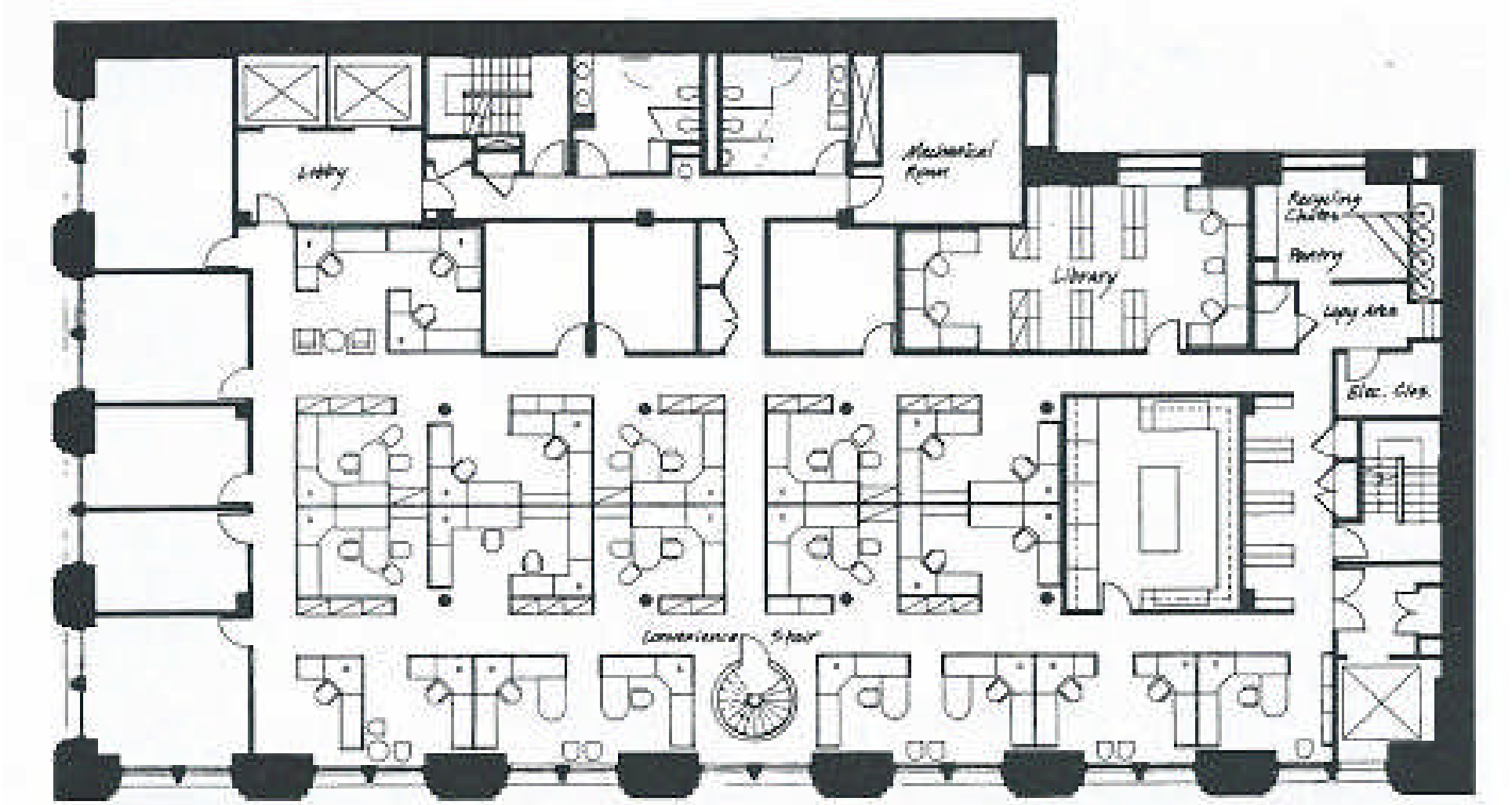
Part 3

Under the Hood

Let There Be Light

"Lighting is the simplest area in which to make substantial energy-saving decisions. If architects or designers were to do only one thing to make a building more energy efficient, I would suggest they look at the lighting design."

Kirsten Childs, **Director of Interior Design, Croxton Collaborative**

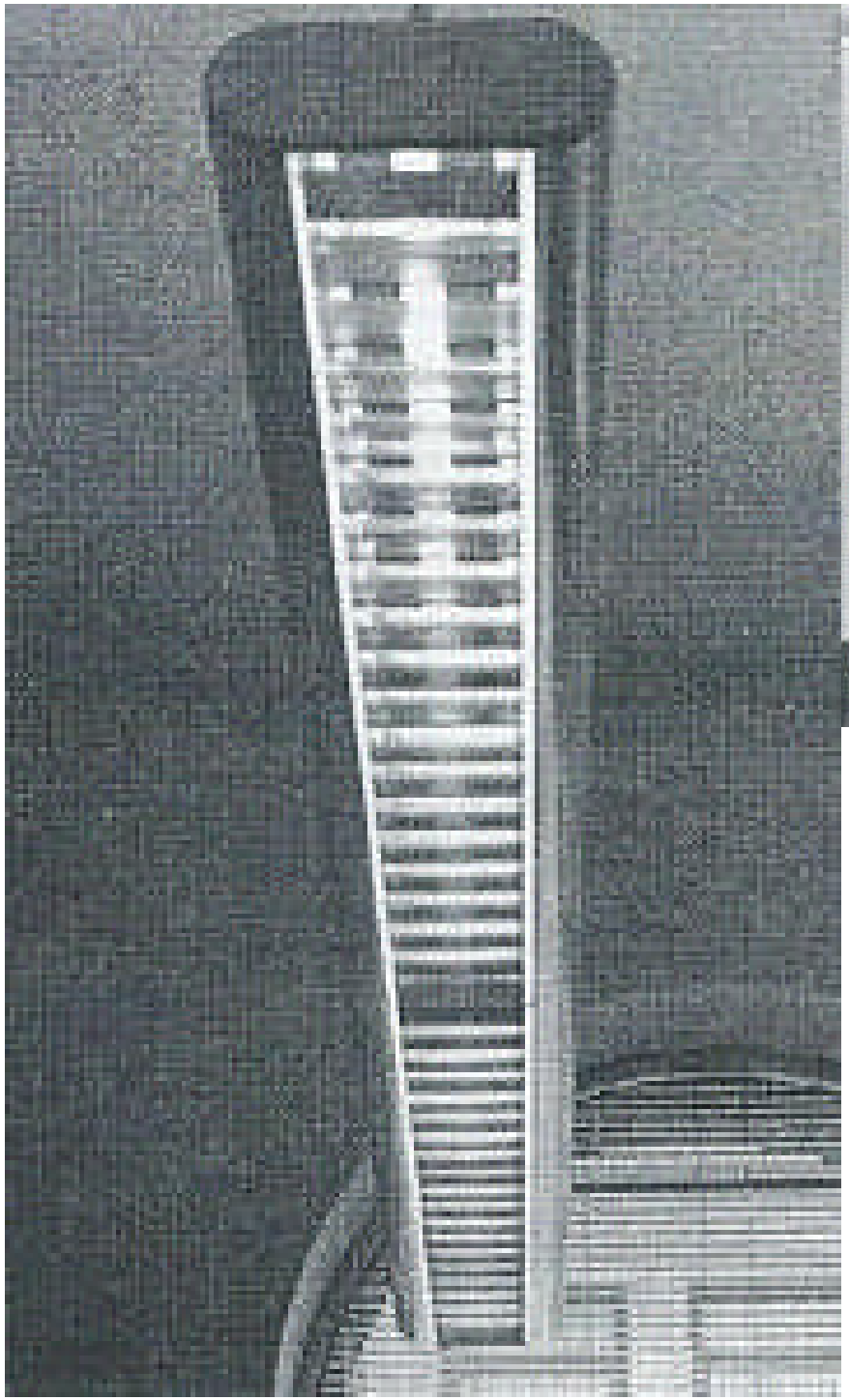


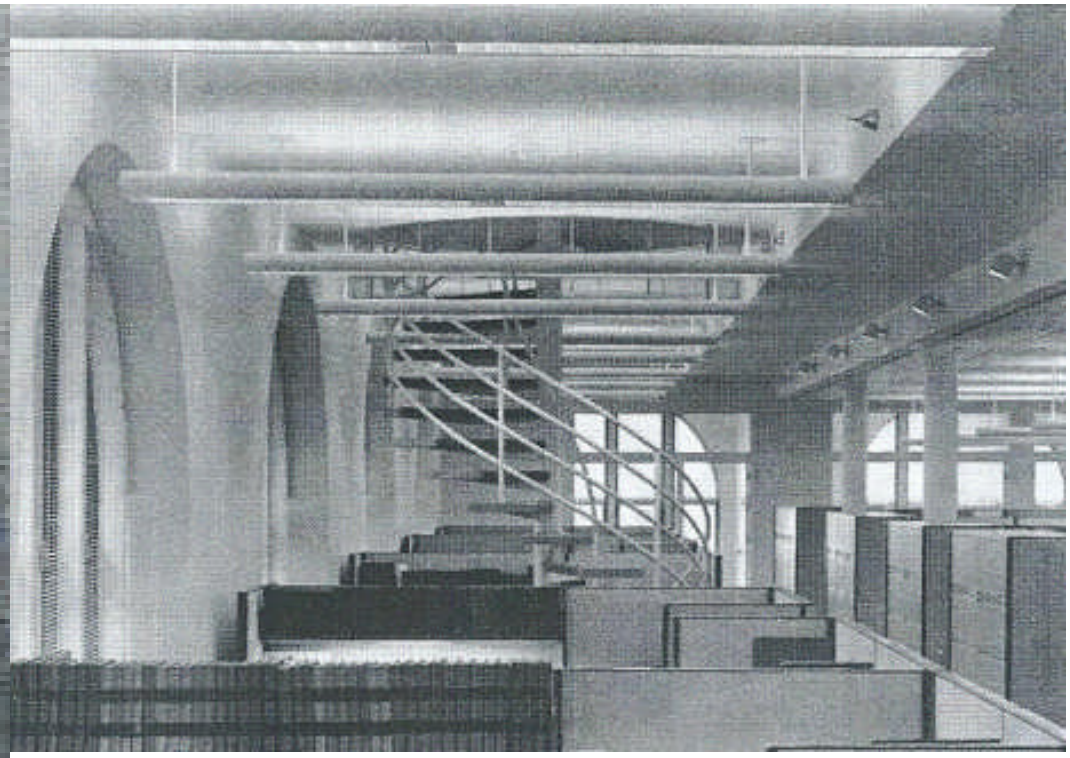
<u>Above</u>: caption: "Drawing of a typical floor plan at Audubon House. The central workspaces feature open plans with modular workstations, enhancing the daylighting of the interior. Enclosed offices are grouped along the western and northern perimeters, minimizing interference with daylighting, and core elements (elevators, fire stairs, pantries, and mechanical rooms) are grouped on the north and east solid exterior walls, away from the sunlit southern and western exposures."

<u>Above</u>: caption: "Audubon House, exterior facing Broadway, prior to renovation"
<u>Left</u>: caption: "Installation of windows. Floor-to-ceiling windows on the southern and western exposures of Audubon House ensured an abundance of natural light. The windows themselves use heat-mirror technology to achieve a high level of insulation."

Top: caption: "Interior, typical central workspace. Notice that the workspace partitions along the perimeters are shorter than those away from window, allowing daylight to penetrate. Walls, floors, and furnishings are all finished in light colors for greatest reflectance of natural light."

Bottom: caption: "Overview of a central workspace area, showing modular workstations. The architectural elements and interior design of the renovation were carefully coordinated to take maximum advantage of daylight, orienting the positions of offices and workstations for full daylighting potential."



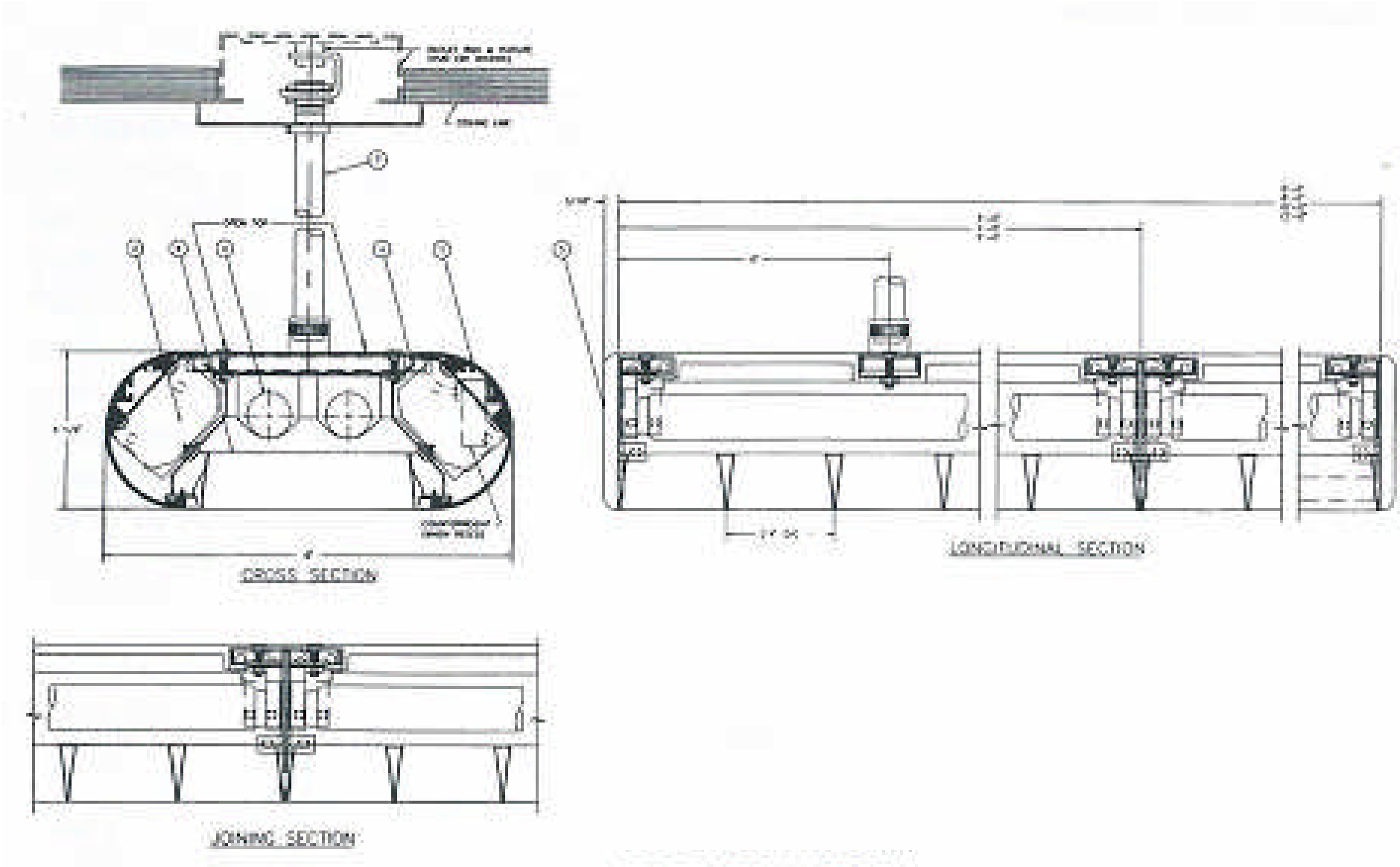


<u>Above</u>: caption: "Interior workstation showing task/ambient lighting system. Unlike conventional offices, Audubon House employs a greatly reduced level of ambient (background) light, while built-in task lights in each workstation provide directed light for working. Both the task and ambient lights use high-efficiency tri-phosphor fluorescent lamps that produce natural colors. The task lights feature a three-way switch to adjust brightness."

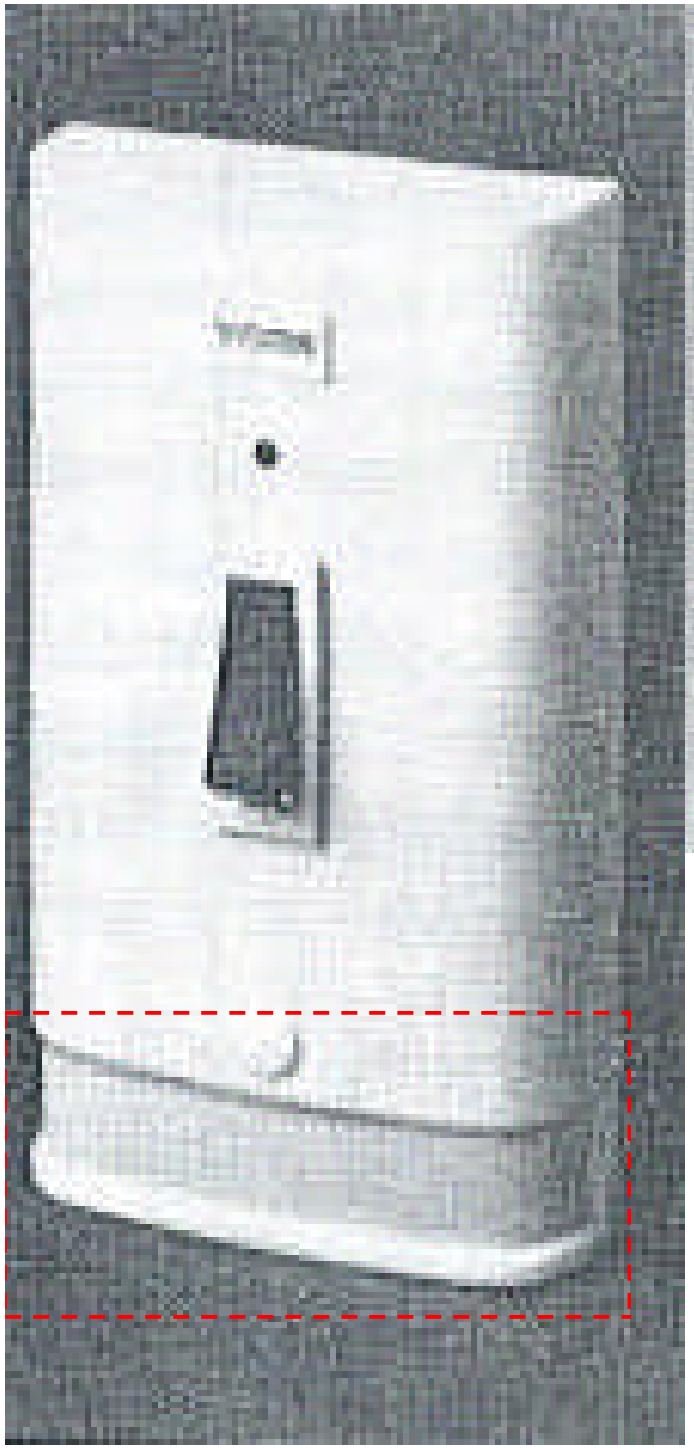
<u>Left</u>: caption: "Linear Lighting's pendant (hanging) fixture"

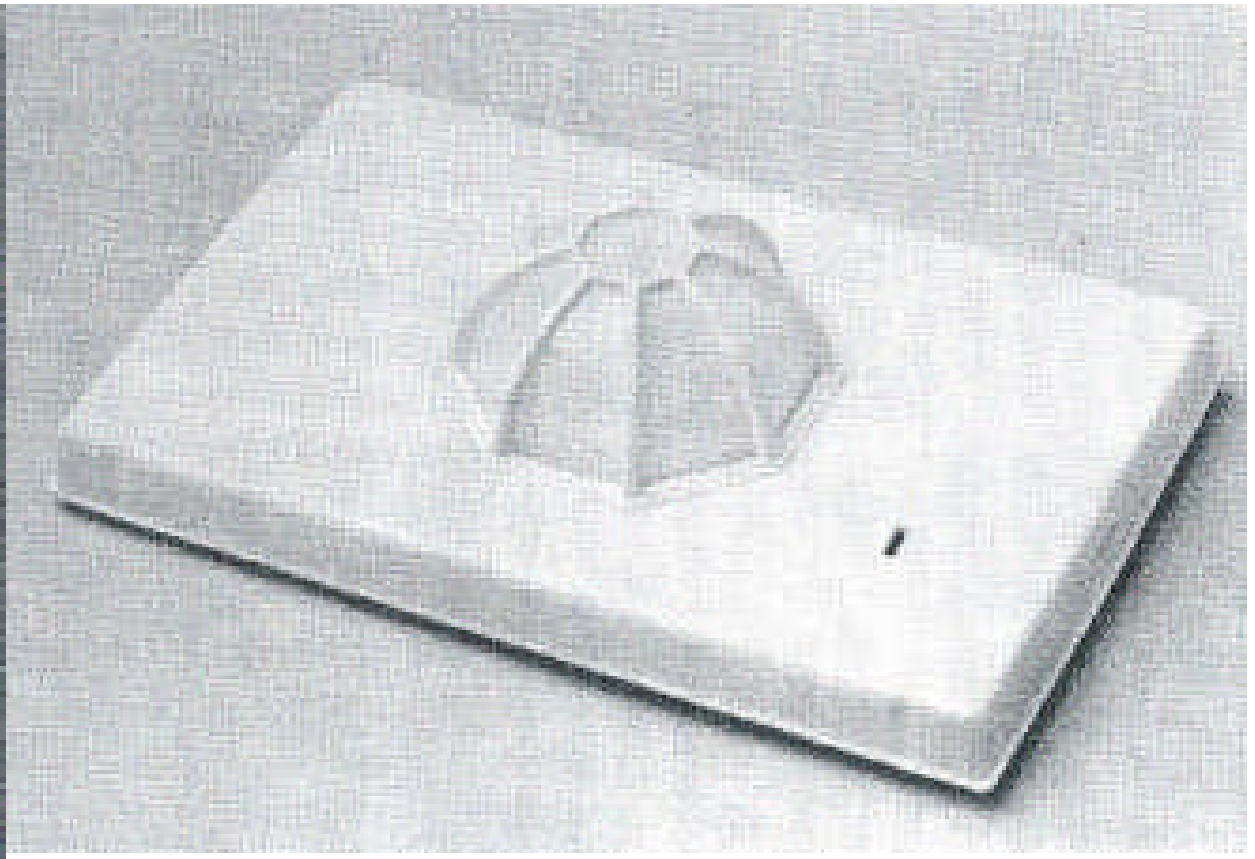
"The typical lighting fixture you find in most office buildings consists of an array of fluorescent tubes recessed into the ceiling and covered by a plastic lens. As a consequence, a lot of light is absorbed inside the fixture and never reaches the space where it belongs. That's an incredible waste of energy. Our design negates that problem with open pendant fixtures, reducing glare and concentrations of light while maintaining a level of ambient light with a more residential feeling."

***Randolph R. Croxton,* Principal, Croxton Collaborative**



<u>Above</u>: caption: "Typical ambient light fixture and lamp, technical drawing. The pendant (hanging) fixture open on top and bottom, provides nearly 360-degrees dispersal of the light. The high-efficiency T-8 lamp is fired by an electronic balast that further boosts efficiency and virtually eliminates flicker."





<u>Above & Left</u>: caption: "Occupancy sensor (left) and daylight dimming sensor (above). Occupancy sensor (strip at bottom), which automatically switch off lights if no motion is detected after six minutes, are installed in almost all offices and workspaces at Audubon House. Daylight dimming sensors are installed along the southern expo-sure. These devices adjust the level of ambient lighting in response to the level of incoming daylight. Use of the two control devices alone saves more than 0.4 watt per square foot, almost half of what the wattage would be without them."

"The savings to Audubon from the lighting design alone will pay back the initial investment in less than three years, and this savings will continue to grow dramatically as energy costs climb"

Randolph R. Croxton, **Principal, Croxton Collaborative**

Not too Hot, Not too Cold

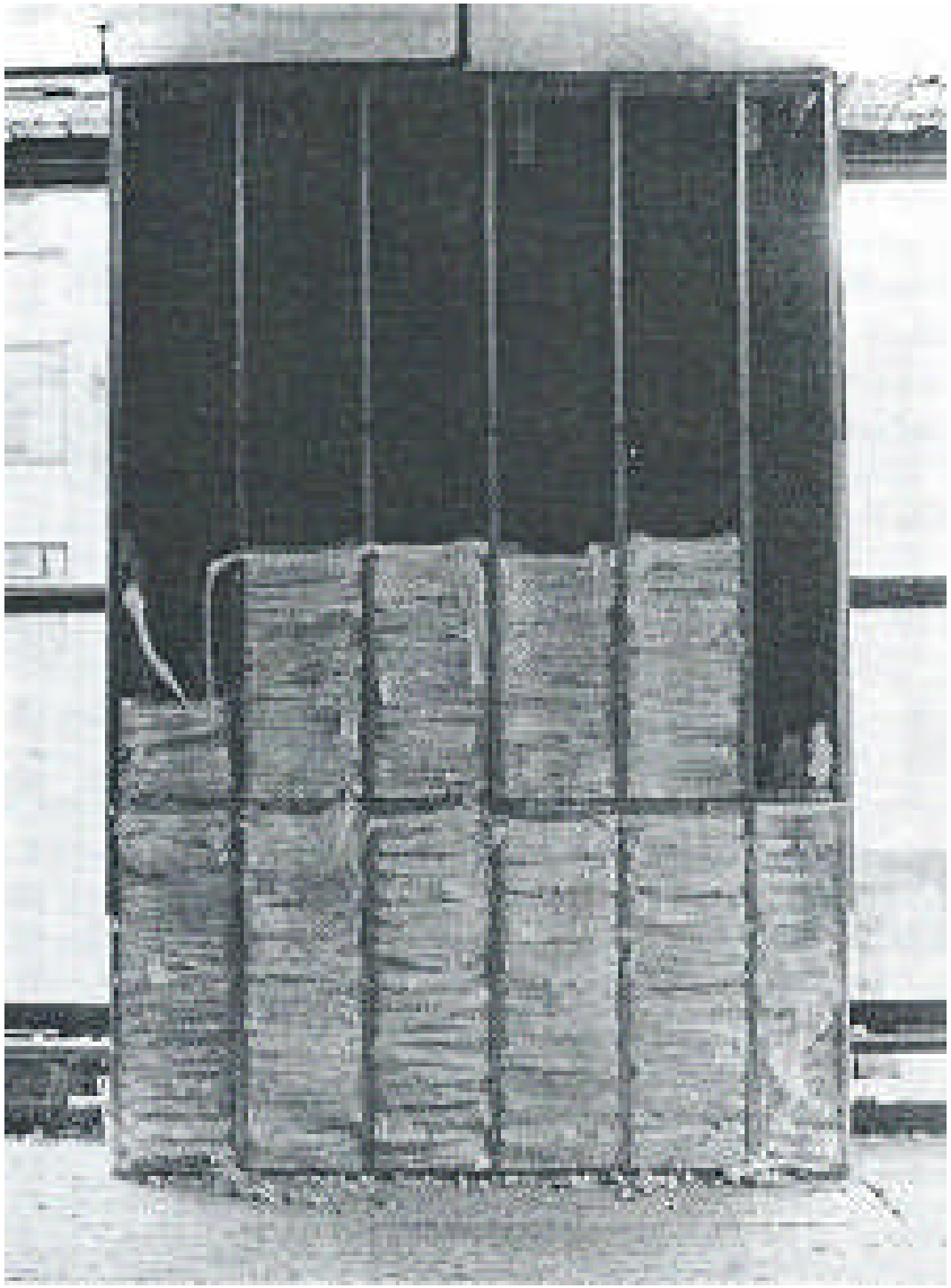
"A well insulated thermal shell is key to an energy-efficient building. Otherwise, all your energy savings will go right out the window."

***Jordan Fox,* Flack + Kurtz Consulting Engineers**

Audubon House's "thermal shell" includes:

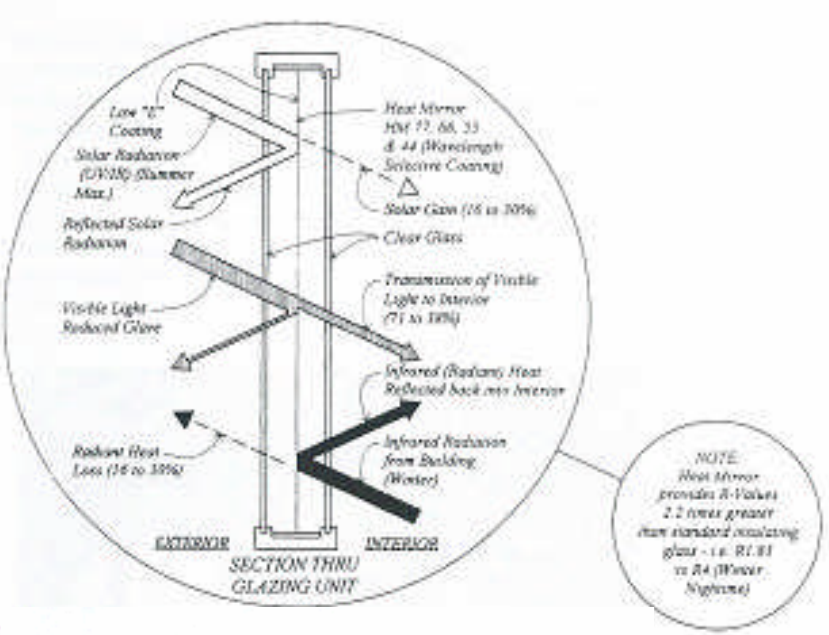
- ***Air-Krete*** **wall insulation - made of non-toxic salt water derived magnesium and dolomite compounds - contains no CFCs. Sufficient thickness of Air-Krete was used to insulate walls to R-12 rating, which is three times that required by the City's Building Code;**
- **Heat-Mirror windows feature a polymer sheet between two layers of glass, which retains heat in winter while deflecting it in summer. The windows insulate to R-4 rating, equivalent to a brick wall;**
- **A great deal of heat in buildings is lost through the roof. The roof of Audubon House insulates to R-33 value, again, three times that required by NYC code.**

National Audubon Society



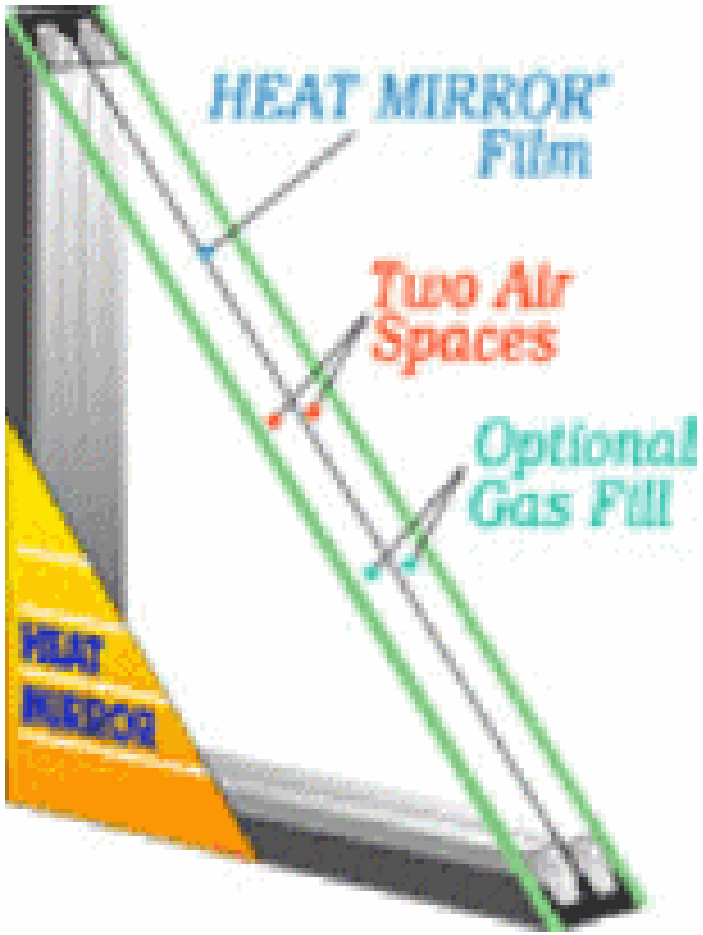
Air-Krete **is a cementitious foam made of magnesium comp-- ounds mixed with dolomite and other minerals. It was air-blown (as a wet foam) into the newly created cavity walls at AH's perimeter. Because it is blown in as a wet foam, it is only suitable for horizontal applic- ations (i.e. walls). On the roof, rigid insulation boards were used.**

<u>Left</u>: caption: "*Air-Krete* insulation in cavity wall. This high-efficiency cementitious foam insulation is blown into the wall, where it hard- ens. It is made with magnesium compounds extracted from sea- water and contains no chlorofluo- rocarbons (CFCs), which con- tribute to ozone loss and global warming."



<u>Above</u>: caption: "Sketch showing how *heat mirror* technology works. Audubon's high-efficiency windows feature this technology – a polymer film suspended between two panes of glass. The chemically treated film is wavelength-sensitive, resisting the transfer of heat through the windows."

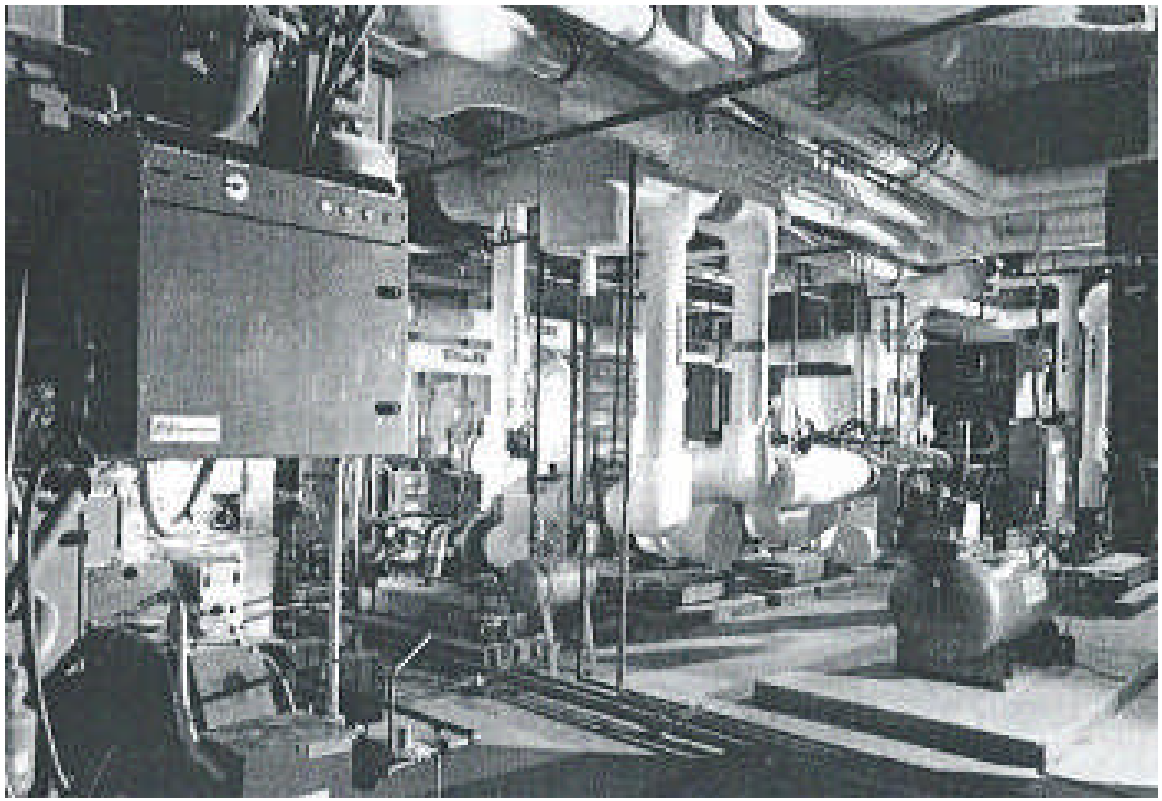
<u>Left</u>: caption: "Installation of high-efficiency windows. The windows at Audubon House have an insulation value close to R-4, equivalent to that of a brick wall. The overall insulation of Audubon's thermal shell exceeded code by as much as 80 percent."



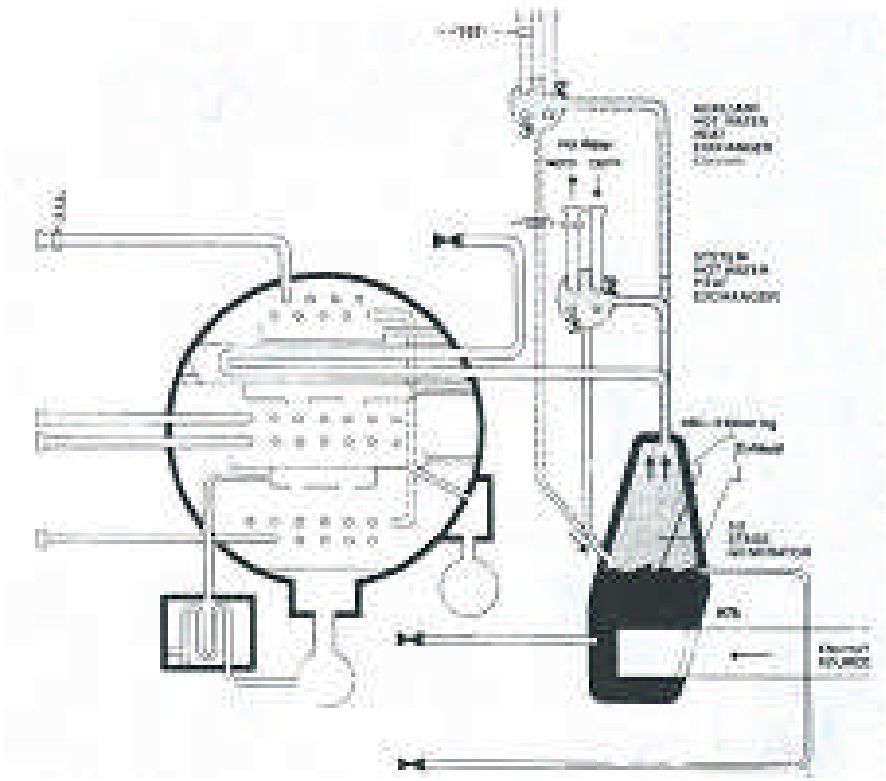
Originally developed by scientists at M.I.T., *Heat Mirror* is a thin film that, when suspended between two sheets of glass, can make a 1-inch thick window just as insulating as the 6-inch thick wall around it. Heat Mirror creates two airspaces in an insulated window and provides maximum energy savings in nine different climates. In November 1999, Heat Mirror was voted one of the "Top 100 Inventions of the Millennium" by *Popular Science* magazine. PS called Heat Mirror film: "one of the more dramatic advances of the millennium." It is credited with saving millions of barrels of oil since its commercial release in 1980.

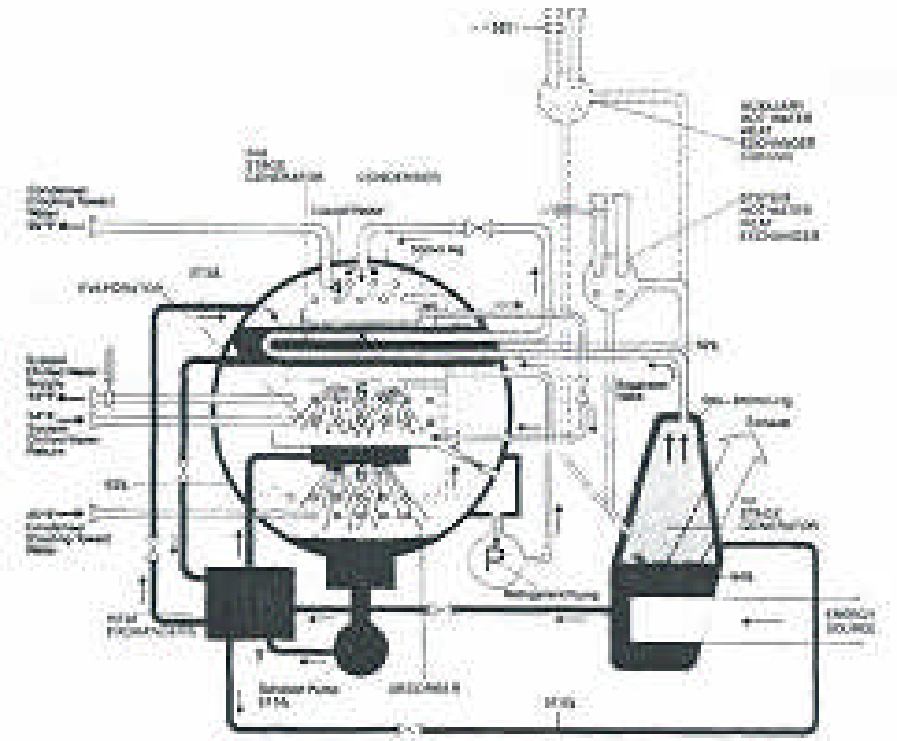
"Utility companies are realizing the opportunities for avoided costs and optimizing their systems through energy reduction and fuel strategies. We see more people – building owners as well as utility executives – becoming advocates for integrated high-performance design."

Randolph R. Croxton, **Principal, Croxton Collaborative**



<u>Left</u>: caption: "Fully installed York gas-fired absorption chiller-heater at Audubon House. This high-efficiency heater-chiller runs on a six-step chilling cycle and a three-step heating cycle. The tight thermal insulation and efficient lighting at Audubon House resulted in the downsizing of this equipment by almost half. The choice of natural gas fuel had major implications for Audubon's environmental goals."

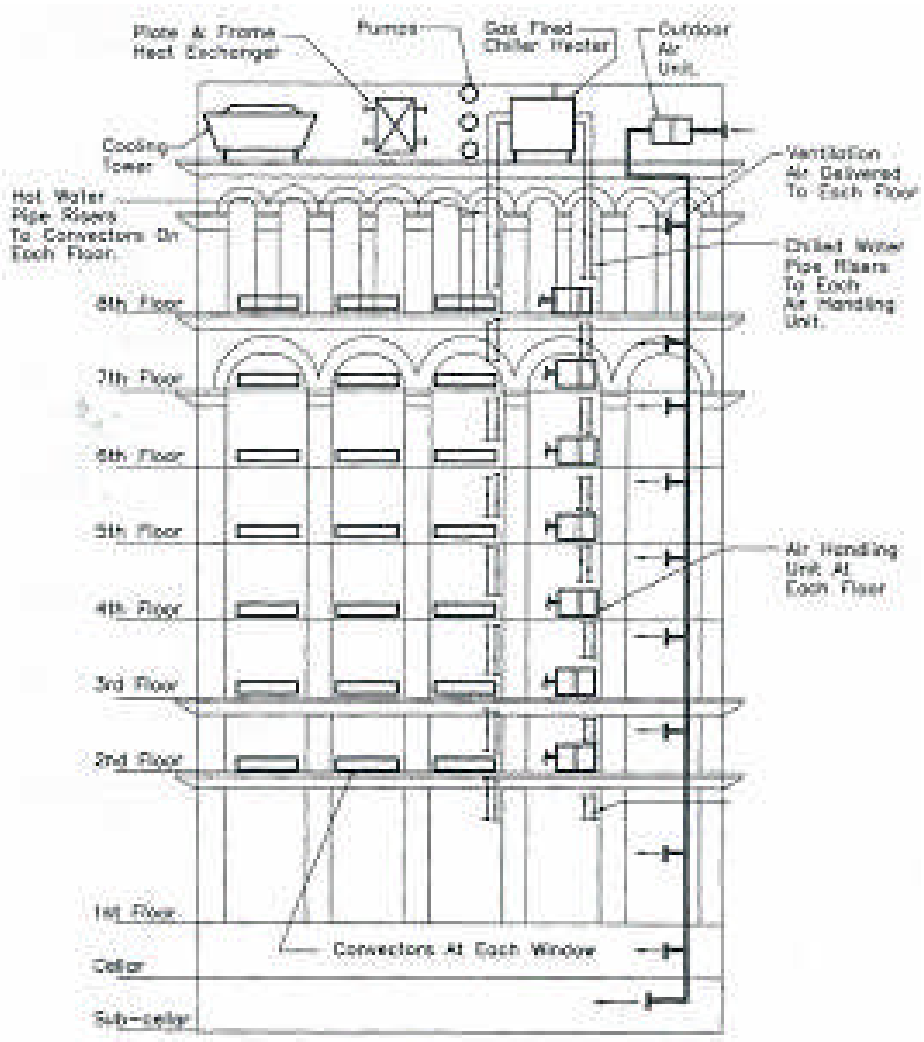




The chiller-heater at AH has a cooling capacity of 180-tons and a heating capacity of 1.7 million Btu per hour. It is known as an "absorption chiller-heater" (a reference to its operation). The three-step heating cycle heats water that is circulated through pipes along the perimeter of the building on each floor. The six-step cooling cycle produces chilled-water cooling coils, cooling and dehumidifying the air before directing it to the occupied offices. The unit itself can be fueled with either fuel oil or natural gas (AH chose gas).

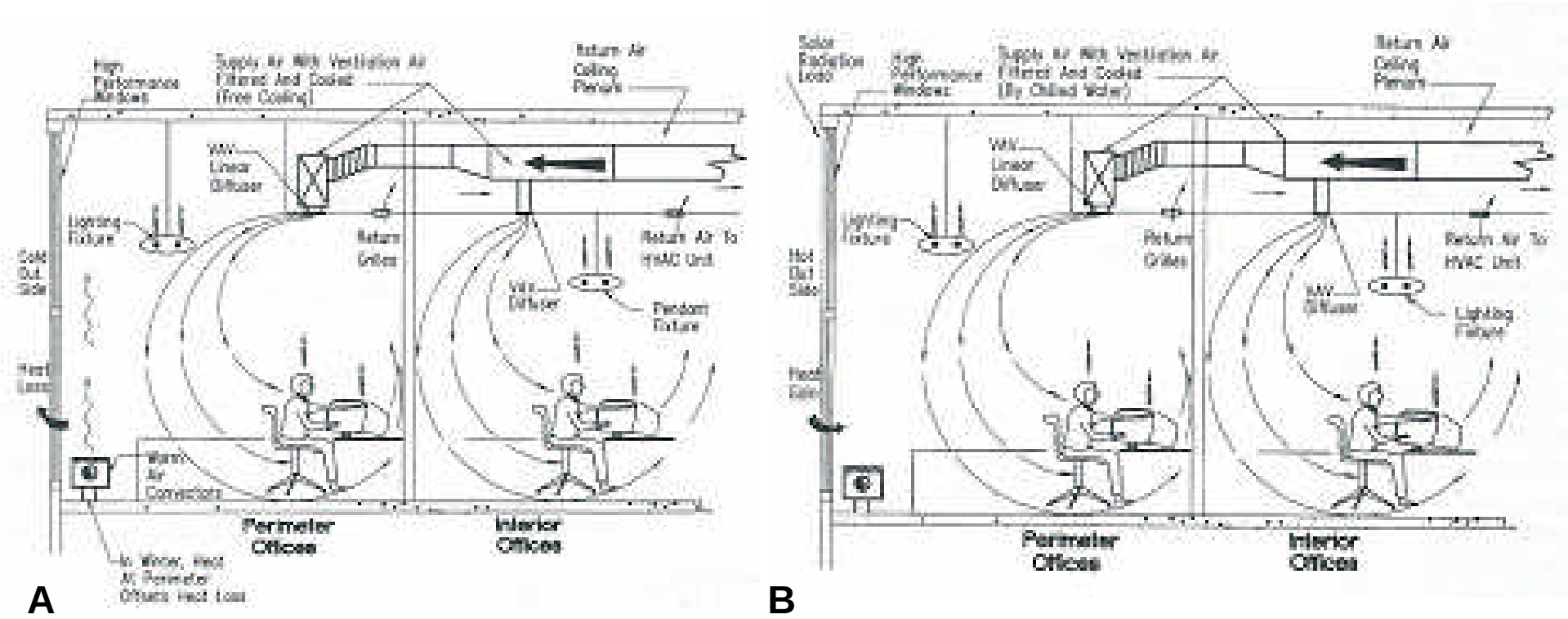
<u>Left</u>: caption: "Schematic diagram of the heating cycle"

<u>Right</u>: caption: "Schematic diagram of the cooling cycle"



<u>Left</u>: caption: "The cooling and ventilation system at AH doesn't rely on a central air distribution unit. Instead, there are individual fan rooms (containing air-handling units) at each floor. Highly filtered outdoor air enters the building at the roof then is distributed directly to the fan rooms where it is mixed with re-circulated return air from each floor, Fans at each floor draw air through cooling coils containing chilled water and distribute the air through ductwork to air terminal outlets. These outlets have temperature-sensing devices (<u>V</u>ariable <u>A</u>ir <u>V</u>olume controls or VAV) which modulate the air volume passing through each outlet in response to space temperature. The amount of air can also be modulated by a fan using a static pressure sensor mounted in the ductwork and a variable frequency drive that electronically slows the fan motor, which reduce energy significantly while maintaining comfort levels.

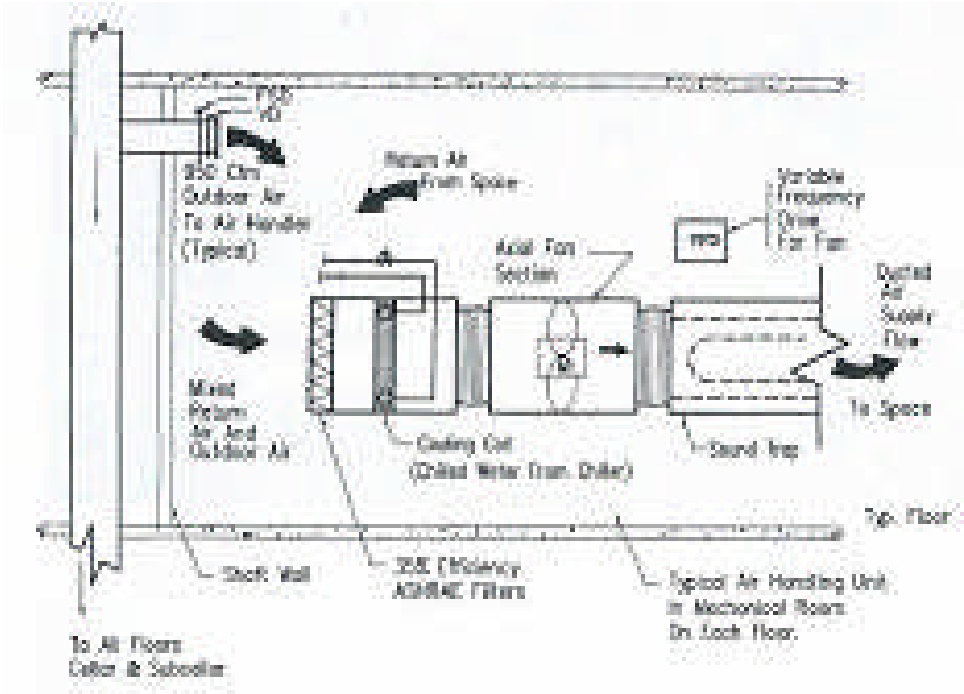
<u>Left</u>: caption: "Audubon House – diagram of elevation with overlay of ventilation system. A high fresh air ratio and high-performance filters ensure that indoor air quality will exceed standards."



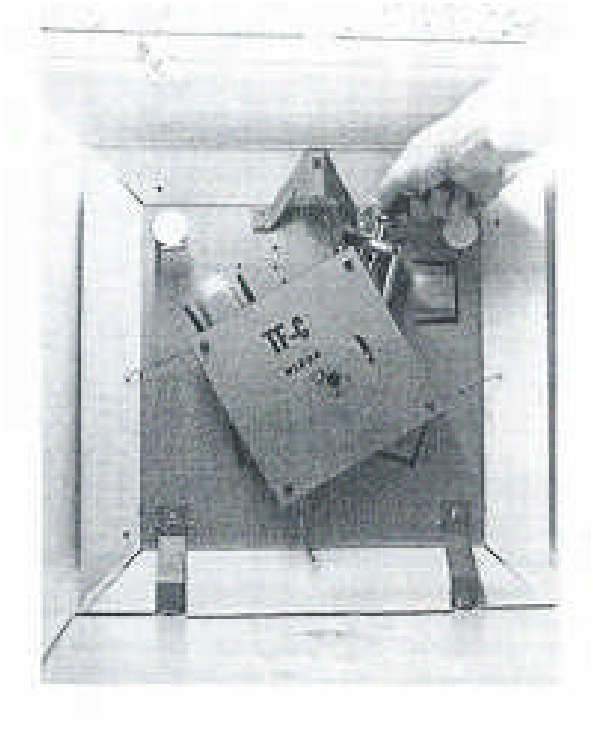
<u>Above L&R</u>: caption: "Cross section of a typical work area, showing features that enhance thermal comfort:

A. In colder months, hot water flows to fin-tube convectors located at the building's perimeter. Warm air rising from the convector acts as a 'curtain' to block colder air along the windows and wall.

B. In warmer months, chilled water flows to cooling coils in the air-handling rooms on each floor. There, fresh and re-circulated air are mixed and cooled. Variable air volume (VAV) outlets conduct the air into office spaces; each VAV box is fitted with adjustable temperature-control diffusers, allowing a high-degree of individual thermal comfort.



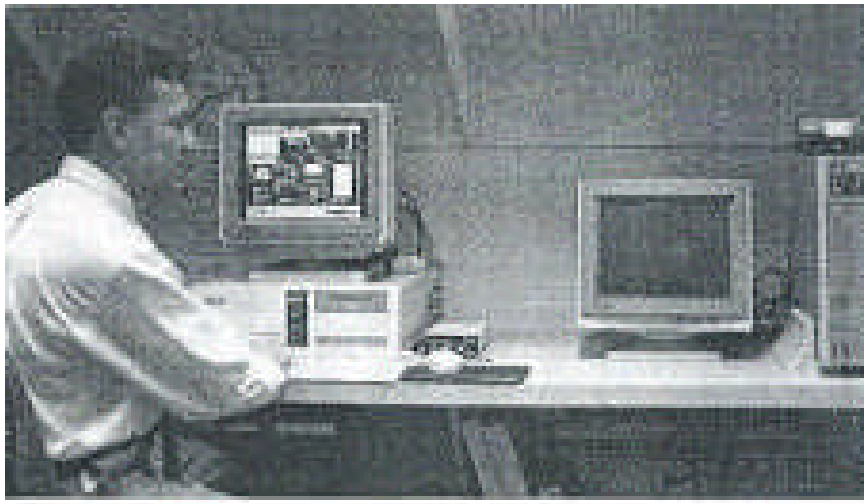
A



B

<u>Top</u>: caption: "Diagram of an air-handling unit. Each floor at Audubon House has its own air-handling room. Here, outdoor and recirculated air are mixed and refiltered. Variable speed drives on the unit fans adjust fan speed according to a pre-set static pressure point – an energy-saving feature."

<u>Bottom</u>: caption: "Variable air volume (VAV) outlet. Located at regular intervals in the ceilings, these boxes conduct air from the air handling rooms to the interior space. Each has a *Thermafuser* to adjust temperature within a pre-set range, allowing each employee a high degree of control over personal comfort."



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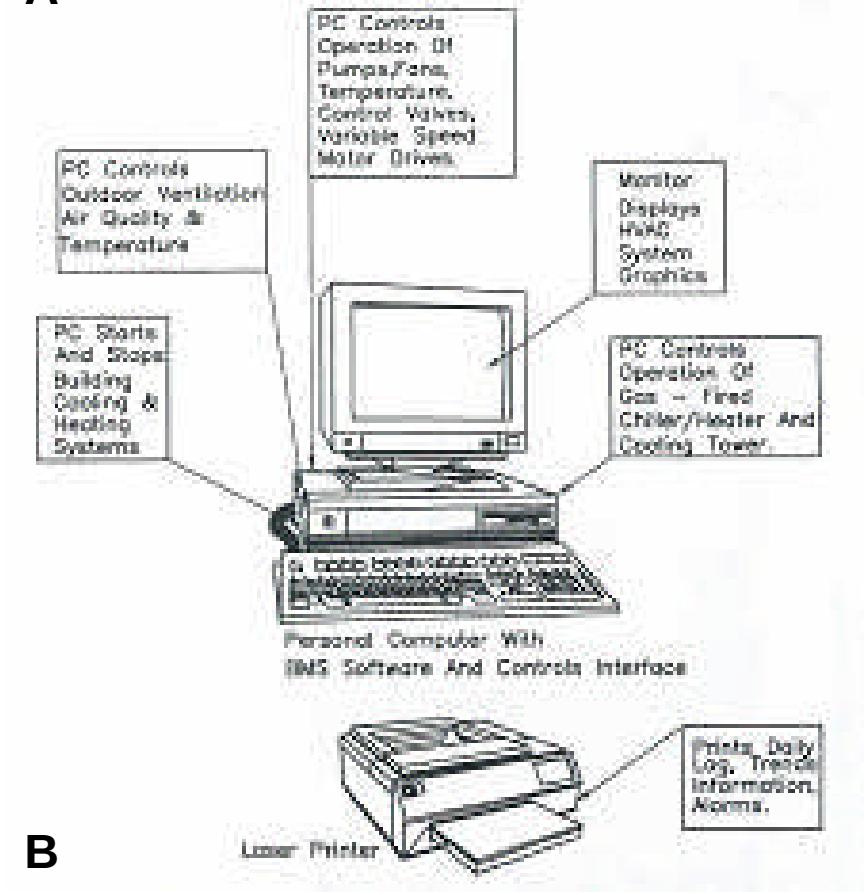


B

Using the central computer system, the building operator's computer can interactively select the least energy-intensive system or combination of systems for a given situation. Thus, it can respond to individual needs and adjust to provide optimal comfort conditions. In its use of passive solar alternatives requiring little or no energy input (i.e. *Heat Mirror* windows), it is partially a *nature-driven* rather than an *energy-driven* system, thus saving significant amounts of energy.

<u>Left T&B</u>: caption: "Computerized building man-agement system at Audubon House:
A. The building manager's computer command center, 7th floor;
B. Diagram of the system.
The building manager can adjust temperatures on individual floors, and the system can automatically choose from among three cooling options, saving substantially on energy."

"The combination of advanced technology and energy-efficient design modifications at Audubon House has created an environment in which the mechanical system operates almost like a high-performance sports car: It has the ability to respond to changing environmental conditions with great speed and accuracy. The heating and cooling performance of the building as a whole has exceeded our expectations. It's more than just an energy-efficient building."

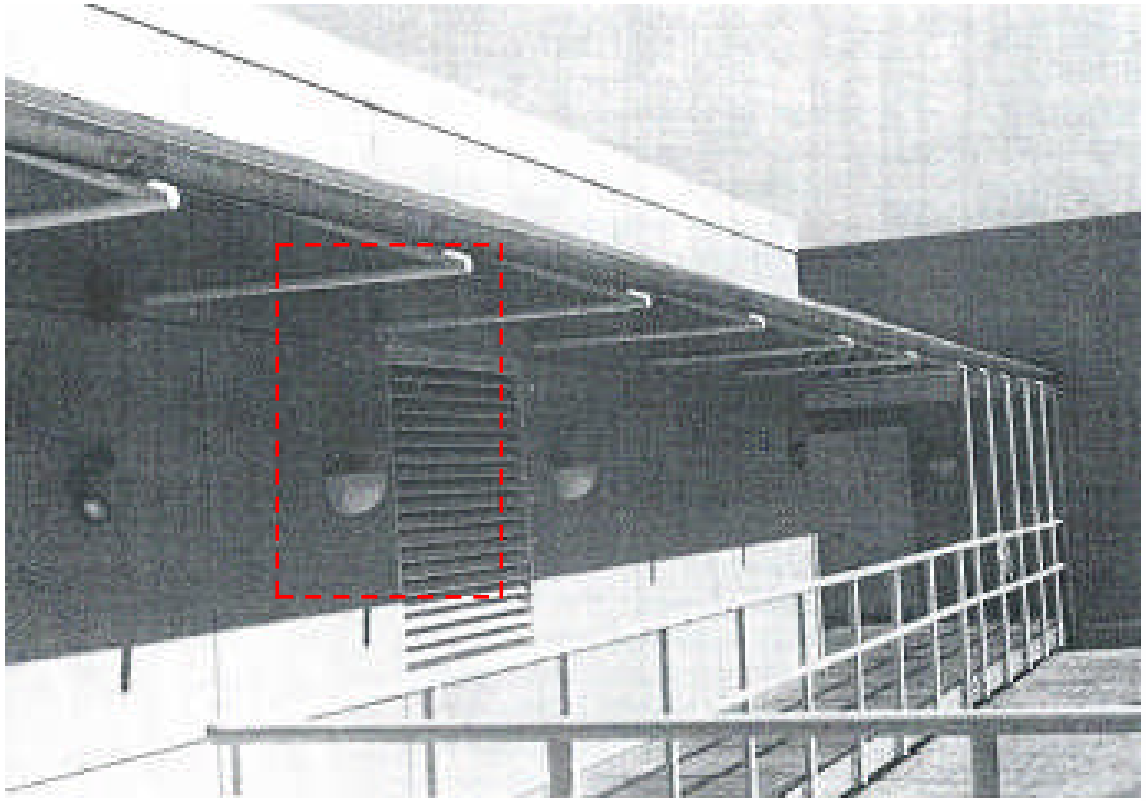
***Jordan Fox,* Flack + Kurtz Consulting Engineers**

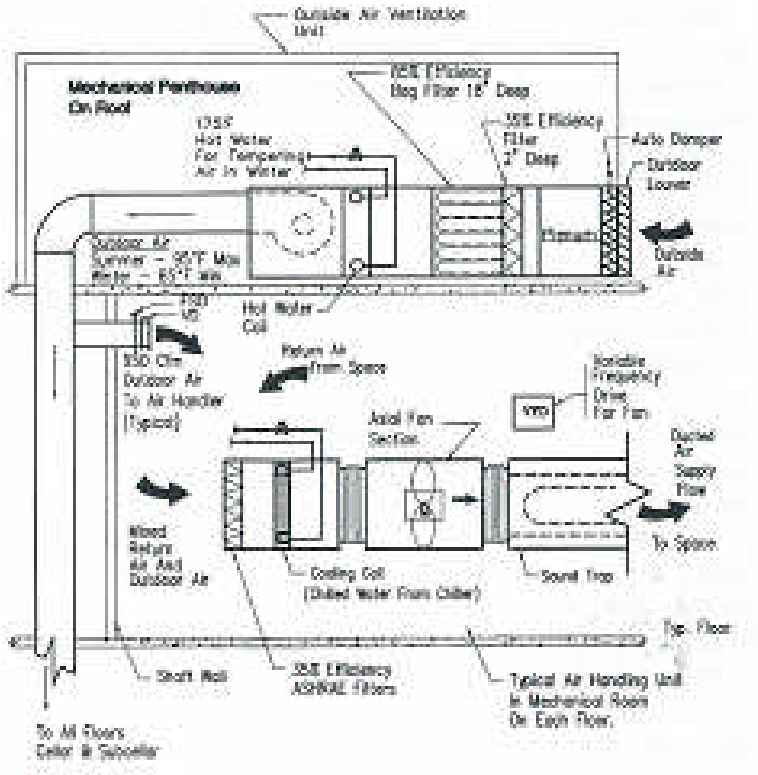
The Air in There

"The placement of fresh air intake vents is one of those things engineers take for granted – with unfortunate results. I have seen plenty of intake vents built over loading docks or right next to the exhaust. At Audubon House, we considered not only the placement of the intake vent but also protecting it from moisture and nearby pollution. As a result, we get the freshest air possible."

***Jordan Fox,* Flack + Kurtz Consulting Engineers**

At AH, the intake vent was/is located at the rooftop level, on the southern exposure (most open side of the building), far from the street below. Such placement ensured that the cleanest available air enters the building. The intake vent is fitted with a grill to filter-out the largest particulates and an overhead rain-guard “eave” minimizes moisture entering the system. AH also provides more outdoor air to each building occupant than did standard office buildings of the era (26 to 30cfm). ASHRAE recommended 20cfm while many existing offices provided 10cfm or less.





<u>Left</u>: caption: "Air intake vent, rooftop level; bag filter for fresh air. Because it is located on the rooftop level and away from the exhaust, the fresh air intake at Audubon House draws the freshest available air. The grill filters large particulates and an overhanging eave minimizes moisture intake. Inside, the fresh air passes through a high-efficiency (AHRAE 85%) bag filter."

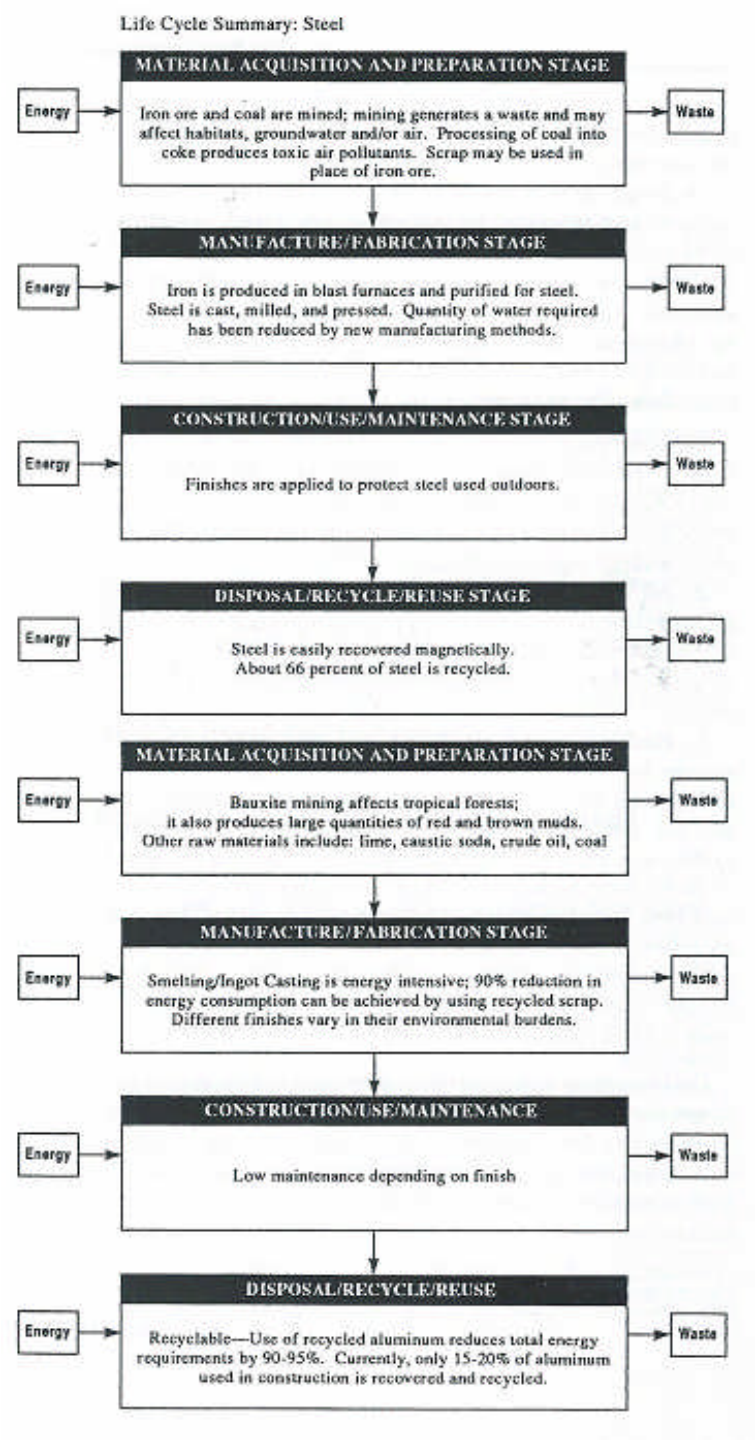
<u>Right</u>: caption: "Schematic diagram showing fresh-air intake and ventilation system. Note that the fresh air is filtered twice – initially with a high-efficiency bag filter (ASHRAE 85%) and again on each exchange."

Dealer’s Choice

"When the environmental advantages of one product over another were minimal, I would agree to purchase the less expensive product. This gave me a degree of flexibility to argue for products with clearly superior environmental advantages even when they cost substantially more."

***Jan Beyea,* NAS Chief Scientist**

The process of purchasing materials/products for the building was one of the most complex and challenging aspects of the project to the AH team. There was a wide array of choices and factors such as:
What was more important?
• The product's impact on *Indoor Air Quality* (IAQ);
• Upstream environmental impacts from the manufacture of the product;
• Downstream environmental impacts from its use and disposal.
Comparing upstream vs. downstream impacts, IAQ generally affects the building occupants more directly. As well, information on chemical composition of materials/products was/is typically more readily available than data on manufacturing processes and/or disposal thus making predictions on IAQ impact/s much more reliable. As such, first priority was given to IAQ by the AH team, followed by downstream impacts and, lastly, upstream impacts. Criteria also considered were:
• Embodied Energy;
• Manufacturer's environmental policies/social responsibility;
• Health/safety conditions at factories;
• Product: performance / economy / comfort/ aesthetics;
• Natural vs. synthetic;
• Chemical off-gassing;
• Recycled content / recyclability.



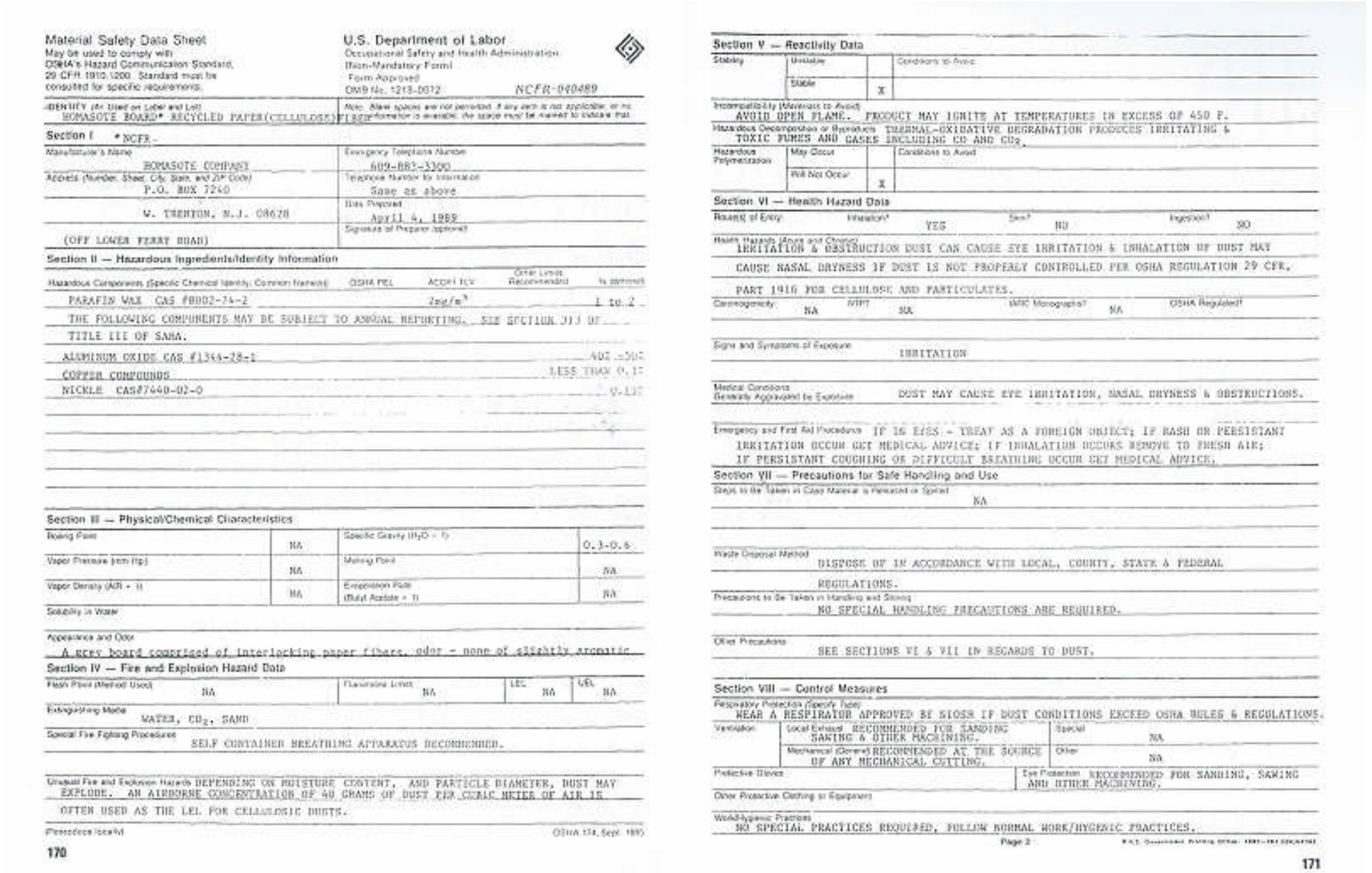
<u>Left</u>: caption: "Embodied energy in steel and aluminum. Energy inputs accumulate in the extraction and processing of any material; this cumulative energy is known as 'embodied energy.' Aluminum manufacture is a much more energy-intensive process than steel manufacture, and thus aluminum generally has more embodied energy than steel. However, factors such as transportation must also be taken into account. Waste is also generated at each step in the process. Recycling can recover all or most of a material's embodied energy."

"No choice is perfect. We have to find the best possible solution under the circumstances, and any analysis depends on site-specific considerations."

***Jan Beyea,* NAS Chief Scientist**

RE: the AH team relied on *Material Safety Data Sheets* (MSDS) to establish the presence or absence of harmful chemicals in material/product. MSDS sheets list the name and amount/s of any substance that poses a potential risk. If such a substance was found on the MSDS sheet, it was checked against a list of cancer-causing compounds (carcinogen/s) provided by the *International Agency for Research on Cancer* (IARC) and/or a toxicology handbook. Thus, this careful analysis established the least harmful choice affecting IAQ, primarily, and the least negative environmental impact/s, overall. Jan Beyea – a recognized expert on paper and plastic products, ranked various plastic products as follows:

- **Polyethylene and/or Polypropylene – Benign;**
- **PET and Polystyrene - Intermediate;**
- **ABS – Questionable;**
- **Polyvinyl Chloride (PVC) – To be avoided whenever possible.**



Material Safety Data Sheet
May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

NCFR-040489

IDENTITY (As Used on Label and List)
HOMASOTE BOARD* RECYCLED PAPER(CELLULOSE)FIBER

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I *NCFR -

Manufacturer's Name: HOMASOTE COMPANY
Emergency Telephone Number: 609-883-3300
Address (Number, Street, City, State, and ZIP Code): P.O. BOX 7240
Telephone Number for Information: Same as above
W. TRENTON, N.J. 08628
Date Prepared: April 4, 1989
(OFF LOWER FERRY ROAD)
Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
PARAFIN WAX CAS #8002-74-2		2mg/m³		1 to 2
THE FOLLOWING COMPONENTS MAY BE SUBJECT TO ANNUAL REPORTING. SEE SECTION 313 OF TITLE III OF SARA.				
ALUMINUM OXIDE CAS #1344-28-1				AOZ -50%
COPPER COMPOUNDS				LESS THAN 0.1%
NICKLE CAS#7440-02-0				0.1%

Section III — Physical/Chemical Characteristics

Boiling Point	NA	Specific Gravity (H_2O = 1)	0.3-0.6
Vapor Pressure (mm Hg.)	NA	Melting Point	NA
Vapor Density (AIR = 1)	NA	Evaporation Rate (Butyl Acetate = 1)	NA

Solubility in Water

Appearance and Odor
A grey board comprised of interlocking paper fibers, odor - none of slightly aromatic

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) NA	Flammable Limits NA	LEL NA	UEL NA

Extinguishing Media: WATER, CO_2, SAND

Special Fire Fighting Procedures: SELF CONTAINED BREATHING APPARATUS RECOMMENDED.

Unusual Fire and Explosion Hazards: DEPENDING ON MOISTURE CONTENT, AND PARTICLE DIAMETER, DUST MAY EXPLODE. AN AIRBORNE CONCENTRATION OF 40 GRAMS OF DUST PER CUBIC METER OF AIR IS OFTEN USED AS THE LEL FOR CELLULOSIC DUSTS.

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Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	

Incompatibility (Materials to Avoid): AVOID OPEN FLAME.

Hazardous Decomposition or Byproducts: THERMAL-OXIDATIVE DEGRADATION PRODUCES IRRITATING & TOXIC FUMES AND GASES INCLUDING CO AND CO_2.

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

Section VI — Health Hazard Data

Routes of Entry: Inhalation? YES Skin? NO Ingestion? NO

Health Hazards (Acute and Chronic): IRRITATION & OBSTRUCTION DUST CAN CAUSE EYE IRRITATION & INHALATION OF DUST MAY CAUSE NASAL DRYNESS IF DUST IS NOT PROPERLY CONTROLLED PER OSHA REGULATION 29 CFR, PART 1910 FOR CELLULOSE AND PARTICULATES.

Carcinogenicity: NA NTP? NA IARC Monographs? NA OSHA Regulated?

Signs and Symptoms of Exposure: IRRITATION

Medical Conditions Generally Aggravated by Exposure: DUST MAY CAUSE EYE IRRITATION, NASAL DRYNESS & OBSTRUCTIONS.

Emergency and First Aid Procedures: IF IN EYES - TREAT AS A FOREIGN OBJECT; IF RASH OR PERSISTANT IRRITATION OCCUR GET MEDICAL ADVICE; IF INHALATION OCCURS REMOVE TO FRESH AIR; IF PERSISTANT COUGHING OR DIFFICULT BREATHING OCCUR GET MEDICAL ADVICE.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled: NA

Waste Disposal Method: DISPOSE OF IN ACCORDANCE WITH LOCAL, COUNTY, STATE & FEDERAL REGULATIONS.

Precautions to Be Taken in Handling and Storing: NO SPECIAL HANDLING PRECAUTIONS ARE REQUIRED.

Other Precautions: SEE SECTIONS VI & VII IN REGARDS TO DUST.

Section VIII — Control Measures

Respiratory Protection (Specify Type): WEAR A RESPIRATOR APPROVED BY NIOSH IF DUST CONDITIONS EXCEED OSHA RULES & REGULATIONS.

Ventilation	Local Exhaust: RECOMMENDED FOR SANDING SAWING & OTHER MACHINING.	Special	NA
	Mechanical (General): RECOMMENDED AT THE SOURCE OF ANY MECHANICAL CUTTING.	Other	NA

Protective Gloves | Eye Protection: RECOMMENDED FOR SANDING, SAWING AND OTHER MACHINING.

Other Protective Clothing or Equipment

Work/Hygienic Practices: NO SPECIAL PRACTICES REQUIRED, FOLLOW NORMAL WORK/HYGENIC PRACTICES.

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Above L&R: caption: "Every manufacturer of a building material is required by law to provide a MSDS sheet (sample above). Following standards set by OSHA, the sheet lists percentages and names of hazardous materials that are components of a product. However, trace amounts of chemicals/toxins are not required to be listed.

<u>Above</u>: caption: "*Homasote,* stacked prior to installation as sub-flooring. This material, made primarily of recycled newsprint pressed and bound with a low-toxic bonding agent. Conventional plywood sub-flooring is a source of formaldehyde and VOCs"

<u>Left</u>: caption: "Wool carpeting at Audubon House. The use of all-natural, undyed wool carpeting illustrates the team's use of natural products as well as to reducing VOC emissions. In addition, the carpeting was tacked down without glues (except on the staircases), further reducing potential sources of VOCs."

"A legislated standard for a product or product assembly may not be the right one to target. You might have to create your own standards for acceptable thresholds of pollutants in materials. It is also important to look for anomalies in the test results of products – for instance, if emissions increase over the test period (despite initial testing results conforming to your chosen threshold). Here may be reason to investigate the product further to determine the source of the increase."

***Kirsten Childs,* Director of Interior Design, Croxton Collaborative**

DRYWALL:

Rather than standard gypsum wallboard, a type with a partially recycled core and outer layer/s (face/s) of 100% recycled paper was used

PAINT:

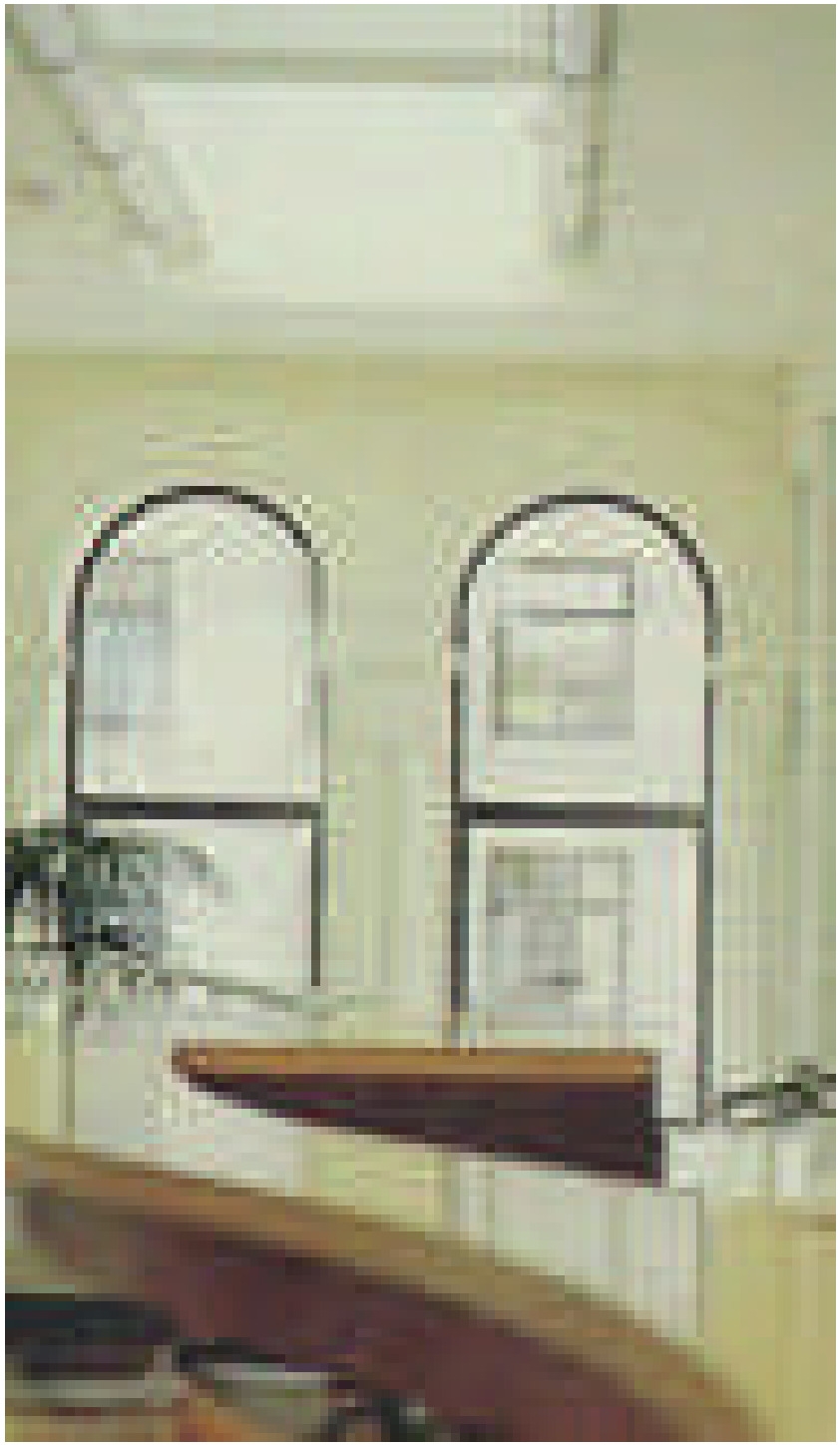
Finding suitable interior paint/s was one of the most difficult tasks encountered by the AH team. Five different "qualities" (for different surfaces) was required. Paints include numerous chemical constituents including:

- **Pigments;**
- **Brighteners;**
- **Fillers;**
- **Preservatives (i.e. Biocides);**
- **Drying agents;**
- **Solvents.**

After struggling with the various pros and cons of different lines of paint, coincidentally, a line of paints came on the market during construction that did not off-gas any VOCs, had acceptable chemical composition/s and was available at a reasonable price. This environmentally friendly choice completely eliminated odors during its application.

ADHESIVES:

The AH team purposely avoided glues made with phenol compounds. Given the only option to use tile adhesives with VOCs, the choice to use the one with "naturally occurring" VOCs rather than man-made (a/k/a "synthetic") was made.



Pressed wood furniture (a major source of chemical off-gassing) was avoided whenever possible by the AH team. Chairs were made from aluminum or steel with low-toxic fabrics and with foam containing no CFCs and/or toulene. Rubberized components were substit-uted for compounds made of PVC plastic. Recycled materials were also used (i.e. recycled steel for workstation shelves, recycled plastic for bathroom countertops) whenever/wherever feasible to do so throughout the building.

<u>Left</u>: caption: "Reception desk, eighth floor. Customized wood furniture at Audubon House is made with sustainably harvested rainforest mahogany certified by the New York-based *Rainforest Alliance.* The purchase of such products is intended to encourage the sustainable use of rainforest resources, ultimately aiding in conservation efforts."

The Three R’s

By purchasing and renovating an existing building instead of building a new one from the ground up, the NAS made a powerful statement in support of conserving both energy and resources. By "recycling" 700 Broadway, the resulting preservation of materials included:

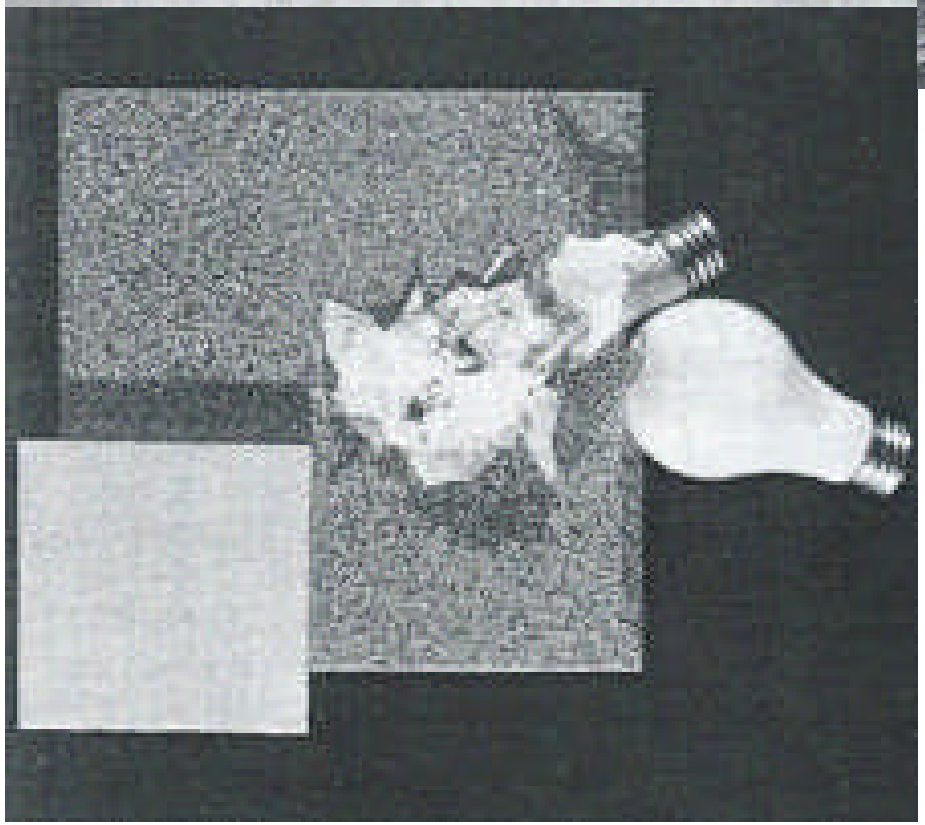
- **300-tons of steel;**
- **9K-tons of masonry;**
- **560-tons of concrete.**

Had the building been conventionally demolished, all this material would have wound up in a landfill, further burdening the environment. Now a landmark NYC building, recycling the building also preserved an important part of NYC's rich architectural heritage. Significantly, had a new building been built on the site, the cost would have been about one-third higher than the $24 million the NAS spent on purchasing and renovating the structure. The spirit of the "Three R's" – Reduce/Reuse/Recycle, was alive and well on the AH project, from beginning to end.

Deja Vu All Over Again

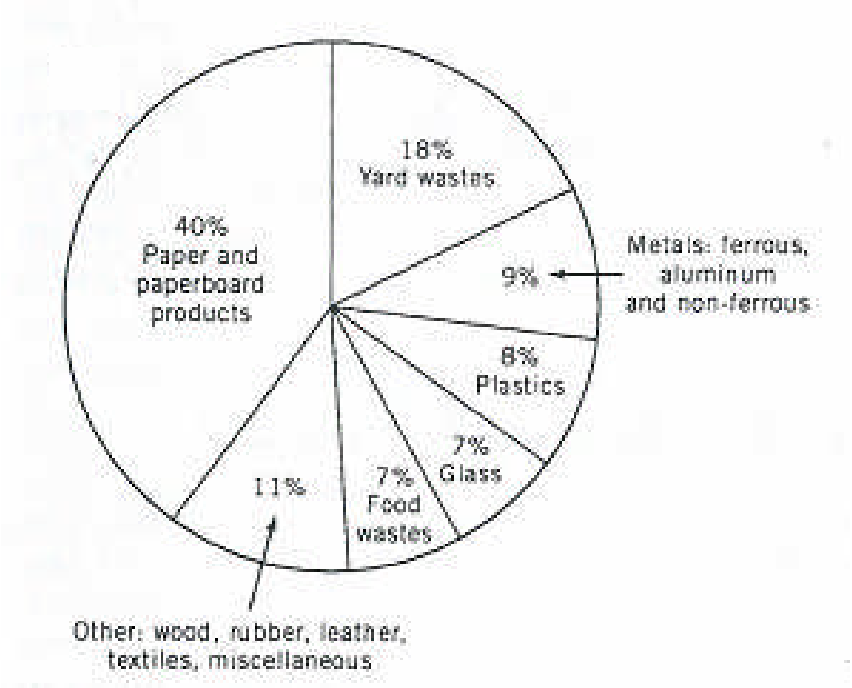
AH used recycled building materials whenever and wherever possible (as long as they were readily available and economically feasible). Some examples include:

- **Bathroom countertops made with a high-density polymer resin compound, part of which comes from recycled post-consumer plastic bottles;**
- **Floor tiles in the elevator vestibules were made from 60% pre-consumer recycled incandescent glass light-bulbs;**
- **Gypsum wallboard made from a partially recycled (8 to 15%) recycled gypsum core and paper faces made from 100% recycled paper;**
- **Recycled steel partition framing and for library and work-station shelving;**
- **Partially recycled aluminum furniture frames (also 100% recyclable);**
- **Sprayed-on fireproofing made from recycled newsprint;**
- ***Homasote* (recycled content) sub-flooring.**



<u>Top Left</u>: caption: "These bathroom countertops are made with recycled plastic from used detergent bottles"
<u>Top Right</u>: caption: "Decorative tiles made of recycled glass in the Ground floor entryway and lobby"
<u>Left</u>: caption: "These tiles, made in part of recycled waste glass from the manufacture of light bulbs, were installed in the ground-floor lobby and elevator vestibules"

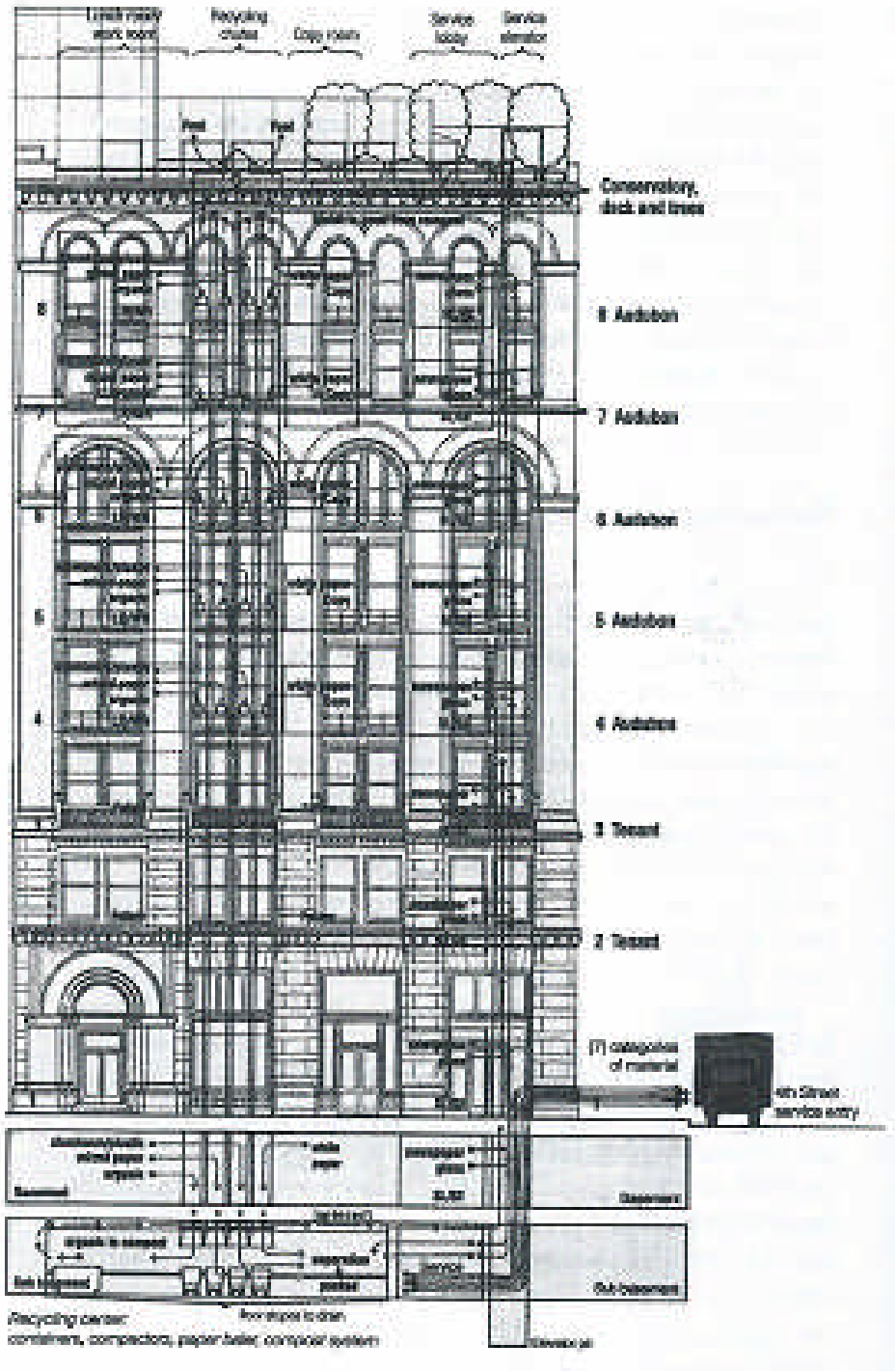
In-House Recycling System



"The average office worker throws away 100 pounds of paper every year. If you consider all office workers in the country, this amounts to an estimated 30 million trees. Our landfills – where plastics, metals, and other office waste are buried – are stretched to the limit. Yet a number of construction and office products made of reconstituted materials are now on the market, and their widespread use would go a long way towards conserving resources and alleviating the crisis in solid-waste disposal."

***Jan Beyea,* NAS Chief Scientist**

<u>Above</u>: caption: "Breakdown of solid waste in the United States. Paper and paper products are the leading sources of solid waste. In office buildings they make up an even greater proportion of the waste stream. Recycling of paper will thus be crucial to any efforts at mitigating the growing 'garbage crisis.'"



At the heart of AH's recycling program is a comprehensive, building-wide recycling system that can recycle approximately 80% of the NAS's office waste. At a cost of $185K, *Waste Management, Inc.* provided both grant money and advice to the project's architect who designed a series of chutes to take sorted materials for recycling from a sub-basement recycling room. The recycling system includes four recycling chutes running the height of the building. The 20-inch steel chutes are similar to garbage disposal chutes used in apt. buildings.

<u>Left</u>: caption: "Audubon House, elevation showing recycling system. Four recycling chutes, one each for white office paper, mixed paper, organic wastes, and plastic beverage containers, run the entire elevation of the building."

<u>Above</u>: caption: "Pantry recycling area. Employees are responsible for bringing their sorted wasted to one of four recycling chutes (one not shown). Some materials, such as glass and newspapers, are picked up from pantry shelves and brought to the sub-basement re-cycling room."

<u>Left</u>: caption: "Recycling chutes under construction. Four chutes run the length of the building, from the 8th floor to the sub-basement recycling room."

<u>Above</u>: caption: "All employees at Audubon House receive two 'waste' baskets for separating garbage from mixed paper, as well as two desktop trays for accumulating white paper and reusable paper, in order to facilitate the pre-sorting of recyclables"

<u>Left</u>: caption: "Sub-basement recycling room. Ample storage space and the installation of separate sprinklers make this an ideal recycling room."

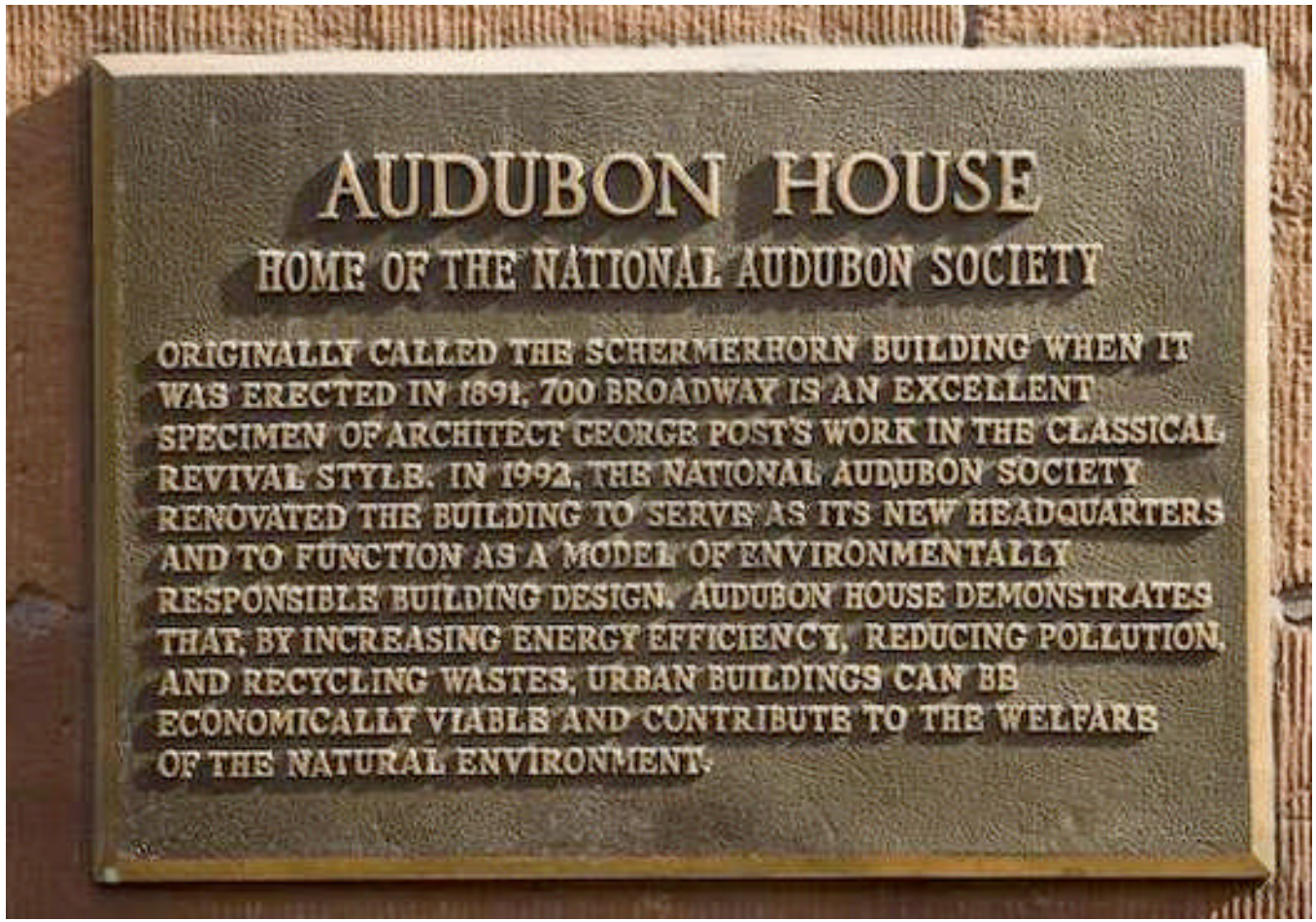
"Audubon adheres to a 10 percent limit in cost premiums for individual green purchases of office supplies, but that does not mean that total purchasing costs will rise by that much. Not every alternative costs more. We don't expect more than a 2 to 3 percent increase in the cost of office supplies."

***James Cunningham,* NAS CFO**

In a Very Real Sense

"In the year since Audubon has occupied its new head-quarters at 700 Broadway I lower Manhattan, Audubon House has been featured on network television, In TIME and News-week, the New York Times and the New Yorker, and in nearly every architecture and interior design publication. It has drawn visitors from every corner of the globe, hundreds of whom have toured the building asking perceptive questions. In a very real sense, Audubon House has spurred a new worldwide interest in 'green' architecture."

***Peter A.A. Berle,* NAS President (1994)**


AUDUBON HOUSE
HOME OF THE NATIONAL AUDUBON SOCIETY
ORIGINALLY CALLED THE SCHERMERHORN BUILDING WHEN IT WAS ERECTED IN 1891, 700 BROADWAY IS AN EXCELLENT SPECIMEN OF ARCHITECT GEORGE POST'S WORK IN THE CLASSICAL REVIVAL STYLE. IN 1992, THE NATIONAL AUDUBON SOCIETY RENOVATED THE BUILDING TO SERVE AS ITS NEW HEADQUARTERS AND TO FUNCTION AS A MODEL OF ENVIRONMENTALLY RESPONSIBLE BUILDING DESIGN. AUDUBON HOUSE DEMONSTRATES THAT, BY INCREASING ENERGY EFFICIENCY, REDUCING POLLUTION, AND RECYCLING WASTES, URBAN BUILDINGS CAN BE ECONOMICALLY VIABLE AND CONTRIBUTE TO THE WELFARE OF THE NATURAL ENVIRONMENT.