

Building a Small Cold Storage Vault

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March 1999

The Image Collection at the National Geographic Society (NGS) was formally established in 1916, 28 years after the founding of the Society, in order to centralize the storage of the by-now thousands of photographs and paintings the Society had accumulated. Photographs and paintings had been saved either because they had been published in the magazine or because they had been received from eager members and readers who hoped their travel photos were just the thing for next month's issue.

Although the Society never had a conservator or a preservation staff until 1982, efforts were always made to preserve the collection so that it would be available for editorial use when needed. A sophisticated retrieval system was developed, and careful records were kept of any materials charged out to editorial staff.

The photographs were stored under office conditions until 1984, when the most active portion of the collection was moved to a slightly cooler film storage room, kept at 68 degrees with humidity maintained below 60%.

In 1983 I had produced an ambitious and, even worse, voluminous proposal that the entire collection, which by then exceeded 10 million, be stored under controlled environmental conditions appropriate to its needs. Although it was strongly supported by one vice-president and several editors, I never even got a response from the decision-making officers. (But I learned a great deal and I was able to make good use of my growing familiarity with the language of heating and air conditioning.)

My colleagues and I continued to research current trends in cold storage of photographs, but made little headway other than minor improvements, such as slightly upgraded humidity control, the use of stable storage materials, and the installation of slab-to-slab room insulation in storage areas previously defined by walls that only reached drop ceilings. These were all important improvements, but we were only able to get them approved because they were cheap.

In the late 1980s I began a systematic analysis of all areas used to store archival collections, and in January 1990, I produced a report on 23 of these areas. It was helpful to me and to the various managers of the collections to have a summary of the storage conditions, and a concise list of recommendations for how they could be improved. Some of the collections had been analyzed in this way in the past, and so data was easy to collect. Others had not, and some heads of divisions were rather reluctant to participate in a survey that might make them look bad.

In 1992 I went back to the storage areas and reviewed the same collections again, and produced an updated report. I had made a lot of recommendations in the 1990 report, and many department heads had used those to their advantage: as corroboration for arguments they might have tried to make in the past, as ammunition to increase funding for upgrade projects, and in some cases, as justification to move the collections outright.

Many of the recommendations had actually been followed to the letter. Imagine my shock!

The following year I began working on a more detailed report for the directors of the most important archival collections. In order to make recommendations of specific hardware changes, I hired Steve Weintraub of Art Preservation Services to walk me through the mysterious world of environmental control. My goal was to create some preliminary designs for the storage upgrades most desperately needed. I hoped that if I made it easy to approve, some of the most dramatic improvements might actually be implemented. I studied books on heating and air conditioning, and posted a schematic next to my desk so I could hypnotically absorb the terminology even when I was working on other more agreeable subjects.

While I was working on this report, we at the National Geographic were entering the business of imagesales. Never before had we asked for the standard market reproduction fee from others who wanted to publish our pictures, but changing times had led to this new way of supporting the collection. In 1993 the right to market the collection was awarded to the operators of the Image Collection, and so older pictures in the collection took on a whole new value to the Society. Suddenly we were no longer giving excuses for retaining eight million old photographs, but rather thinking up ways to make money off of them, and it seemed like a good time to ask for money to preserve them.

In late December, Maura Mulvihill, the director of the Illustrations Library, mentioned my endless campaign for cold storage in a meeting with the editor, her boss. He seemed very receptive to the idea, and so she let me know that NOW WAS THE TIME!!

Working quickly, Maura and I put together a request for a small cold storage vault on the grounds that the new department of Image Sales would both justify the need for better preservation, and also help to pay for it. During the first few weeks of 1994, I went into research overdrive, counting photographs, measuring file drawers, and estimating how many pictures in our current storage would fit into a more compact arrangement in the cold vault.

After determining how many pictures we would want to store, and how much space that would require, I called in several contractors and met with our in-house engineers. We settled on a size and location for the vault, and, on February 3, using numbers we came up with at the speed of light, I submitted both a budget proposal and a design for a cold vault, included in the report I had been preparing during the previous year.

With the assistance of Jim Wallace, chief of the Smithsonian Institution's Office of Printing and Photographic Services, and of Steve Weintraub, I came up with a general design and set of specifications for the box: A simple Bally box with a vestibule, the main room to be kept at 40° F. and 35% RH. The vestibule would be cooled with air blown out from the back room

until it reached 60° F. Both the cooling and dehumidifying equipment would be backed up with identical systems.

I obtained estimates for the job from three major refrigeration companies, and settled on G & H Insulation, Inc., a company that had done a lot of work for Jim Wallace. I submitted their estimate of \$38,000 for construction and installation, in addition to which I asked for \$7,000 for wiring, plumbing, and furniture.

A storage capacity of around 400,000 35mm slides was estimated using enamel and steel Stanley-Vidmar hardware cabinetry, a system of storage we have used for decades. Of the many drawer sizes available, we primarily use 2.5 inch-deep drawers divided into 10 two-foot rows to hold slides. Each of the cabinets we selected holds 17 drawers and stands about five feet high.

The space inside the box is about 9' by 8', and 9.5' tall, with a vestibule about 4' by 8', just big enough to handle the door swing and a couple of cupboards. This size was selected based on the size and number of cabinets we needed to store, and the size of the foam-filled panels from which the walls of the Bally box are constructed.

We already had a general budget for the construction of the storage vault, but had not yet looked at the costs of duplicating slides before they were put into storage. Gathering data to price out this aspect of the project was a challenge. We needed to know at what rate slides would be duplicated, and how many dupes we would need, before the lab could even begin to estimate their costs. Then we would need to consider the time and computer equipment we might need to add the dupes to our database. The new business of selling images outside the Society was showing signs of huge success, and already the call for originals was accelerating.

How many dupes would we need, and how would they be used? Due to the increased use of a digital image search system, most of our Image Sales staff could pre-edit their requests before the originals had to be disturbed. Their clients could only get a dupe anyway, and the Sales staff would merely take the originals to the lab to be duped and then immediately return them. But there were still plenty of occasions in which the originals would go into the editorial process, sitting in a layout on a light table for weeks or months. How could we minimize the removal of originals from cold storage for such a purpose?

Since none of our collection had been routinely duplicated for circulation, we designed a theoretical process whereby certain transparencies would be duplicated and then transferred to cold storage, and others would be duplicated as they were needed and the originals also moved to cold storage. It would mean a lot of work for an already overworked department, but Maura felt comfortable dealing with that after the project was approved.

Four days after our meeting, on Monday February 7, Maura responded to the editor with an outline of our plan and a request that we proceed with a request for proposals. On Monday, February 14, he gave us the go-ahead to obtain estimates for the installation of the cold

storage vault, a step that was already complete, and within a week I had a final budget to submit to him, which he approved, obligingly, before I left his office.

Within three weeks, on March 7, the vault was constructed and ready to install.

The proposal approved by management was for a modest cold storage vault designed primarily for storage of 35mm original color transparencies, our most plentiful archival format and medium. It was exasperating that I was able to obtain approval for this project not on the strength of my arguments for extending the life of our culturally, artistically, and historically valuable originals, but because now that we were selling reproduction rights for some rather handsome fees, management was suddenly impressed with the monetary value of the collection.

Of the three locations we had considered, one was rejected as too expensive and restrictive. This was a small closet in the Image Collection's offices on the fourth floor. Although it would have been very convenient, excess heat would have to be exhausted through floors and walls to the outside, and of course the refrigerant would also have to travel up through three floors to the condenser on the roof and then back again. The costs just to x-ray floors and walls prior to construction would have exceeded the projected cost of the cold vault itself, and maintenance of the system would be a nightmare. Moreover, the lack of any usable space around the closet made it difficult to locate the equipment, and impossible to permit any expansion.

A second location offered to us by building maintenance was in a parking garage. Installation and maintenance would be a breeze, but it was extremely unappealing to store photographs in an area where cars were parked.

We easily rejected this in favor of a third option, a former parking garage now being transformed into general storage. It had all the advantages of the parking garage, but the air was not polluted by car exhaust; in fact, the ambient air was spill air from the museum just one floor above. There was room to double the size of the box if needed at a later date, and although it was inconveniently located, we judged that not to be sufficient an objection to outweigh the benefits.

Installation of the box went smoothly, with full support and participation of the National Geographic engineering staff, to whom I am deeply indebted for their help. Anticipating the eventual need for the NGS engineers to take over maintenance of the box, I asked that G & H call them instead of me to make all arrangements for installation, and so, while it demanded more of their time, it meant that our engineers were able to have a hand in the entire installation and were that much more familiar with the equipment and systems.

Installation was complete in three weeks, and on April 1, just two months after our original estimate was received, we had a final walk-through. The systems were fully tested by May 1994. By this time we had decided to drop the humidity set point from 35 to 30%, and this was achieved with ease. We changed from one system to the other without a perceptible rise in temperature or humidity. The HVAC system seemed to be working perfectly. However, I

decided to put off transferring the photographs into the new cold storage box until November or December so that we would have a chance to observe it in operation through the summer, the most challenging weather conditions.

Meanwhile, I began a series of storage and staging tests to determine what (if any) materials would be too sensitive for the storage conditions and staging procedures we had designed. I conducted real-time delamination tests with adhesives and glass negatives, and had no detectable results. I had been aware that emulsions on glass might have a problem in the less-than-30% humidity levels, and also wanted to see what we might get when we put slides sealed in glass mounts in the near freezing temperatures. I found no evidence of microclimate problems, and no adhesion changes.

Only one major problem arose during the summer. This problem could have spelled disaster for any film that might have been stored inside had we not opted for this long engagement.

The theory of refrigeration with dehumidification is that once the box is cooled and the air dried, very little more needs to be done to keep it that way as long as the doors are kept closed. However, as spring changed to summer and the moisture in the outside air increased, our system seemed to have a difficult time keeping the relative humidity near the set point. This was inexplicable, and resulted in our having to pipe water away from the dehumidifier because it was working so hard.

We became aware that we had a serious problem when we discovered water leaking from the back-up dehumidifier into the cold. This was especially perplexing in that as this unit was not even running, it was difficult to understand how it was generating excess moisture. Even stranger, when we switched systems, the dehumidifier that had been leaking was running perfectly, and the other one-now turned off-was leaking. For weeks, G & H and our own engineers combed the systems trying to solve this problem.

After much tweaking and adjusting, including trying to re-synchronize the limits set in the engineers' Delta monitoring system (which was continually going to alarm) with the set points in the refrigeration system, G & H determined that the problem was not in the dehumidifiers, or any of the equipment, but was actually being caused by the vestibule. We were blowing air from the back room to the vestibule to cool it to 60° (which it needed frequently when the new cabinets were being loaded in, hence the sudden eruption of the problem), but we had neglected to provide a way to replenish the air in the back room. We were creating a low-pressure situation that was being relieved by sucking air through the only crevices available, the unused dehumidifier. This 74°+ outside air had a high summer humidity, and on meeting the cold equipment inside, was giving up its moisture content in the form of condensation, which was then running out of the unit and into the cold room.

We easily solved the problem by installing a small one-way vent or transfer grill between the rooms. This vent is covered by gravity dampers that blow open when the pressure in the vestibule is higher than the pressure in the cold room, and close when the pressure is equalized; thus, it is always open when the fan is blowing cold air from the back room into

the vestibule. Although this introduces some warmer air into the back room, the system handles it easily with only a momentary increase in temperature and humidity.

The installation of a system of waterbugs, inexpensive water detectors attached to a remote alarm, relieved any anxiety I was left with after this episode. In fact, other than two brief power outages and a minor leak onto the top of the vault from the floor above, we have had no subsequent crises to contend with.

Clearly, the lack of circular ventilation was a problem that should have been uncovered in the design phase, and we were all more than a little embarrassed that we hadn't caught it. But what kept it from being a disaster was:

- (1) that we had delayed putting film in the box so that we could observe it over the summer, and
- (2) that the designers stuck with us until the problem was solved.

Finally we were ready to move the originals into cold storage. We decided on a transfer protocol, one that differed considerably from our original plan. Rather than move the older material all at once, we would move current materials as they were added to the collection, and make dupes as they were moved to cold storage. And with the adoption of this plan, for reasons I have not yet sorted out completely, we stalled for over a year.

I had expected that by the time I gave the go-ahead for original film to be moved to the cold vault, the clerical steps needed to do it would have been worked out. But in fact, once the vault was a reality, it appeared that the staff began to consider it not such a good idea after all. For a full year, various clerical and procedural questions percolated to what had appeared to be a calm, serene surface. I was surprised to learn when I inquired that no progress had been made at all to solve those problems.

But what was really lost? We had gotten our cold vault approved during a very narrow window of opportunity, and if the rest of the project needed more time, that was fine. I decided to pick my battles selectively, and this one wasn't serious enough. I did, however, threaten to store my wine collection in the vault if things took too long.

Everyone was busy just keeping up with the new Image Sales, and the introduction of a new routine and additional work was studiously ignored. Besides, there were all kinds of excuses for not wanting to use cold storage: The room is too cold to work in. The circulation staff doesn't have time to go down there every day. The database doesn't have a way to describe the new location. But gradually, as the months dragged on, the clerical and database problems were worked out, and the protestations dropped to a quiet grumble.

Finally, in December of 1995, twenty months after the installation of the vault, the first original film was placed in cold storage. And within another year of fits and starts, newly published material was routinely being stored in cold storage. Most of the problems were solved or wrestled into submission, but the routine associated with cold storage has caused some problems that will likely be with us forever.

Several staffers have found that their constitutions are too delicate to abide the cold conditions, and so the heartier members find themselves shouldering the burden. Some, as it turns out, find it to be quite the vacation to visit the cold in midsummer.

The clerical adjustments have proven to be somewhat less monumental than some had expected. For the most part, once decisions were made regarding the addition of a word to a menu, or a field to a screen, it was a simple matter of asking our computer programmers to make the change, and six months later it was done. At the present time, some four years later, the database is completely at home with the new filing location, and has in fact incorporated an additional three location names since then.

Staging procedures have proven to be a minor concession. Although most of the editors, when asked in a survey, responded that they would not be able to wait the additional time for slides to come out of cold storage, that has not proven to be the case. They wait, and after four years, they don't complain.

Jim Wallace helped me design a staging procedure that has proven to be satisfactory and not overly inconvenient. Although slides tend to languish on their way into the vault, since volunteers to refile them are scarce, there has been no report of condensation or any other sign on slides coming out.

We decided that zip-locking bags were adequate to protect the slides during the staging process, and that makes the process much less complex. At first I was afraid we would need greater protection, such as Pelican boxes, but that is simply not the case.

In four years the Cold Storage Vault has faded into the daily routine. The engineers have the box on a regular maintenance program and it is monitored around the clock. Editors know about cold storage and accept the additional waiting period. Slides are routinely duplicated before they go into the cold room, and so they are infrequently needed afterward.

In order to minimize the removal of originals from file, and to speed their entry into cold storage, a new project for me during the last year has been the mass duplication of thousands of original slides. The increased use of the collection brought in by the sale of images outside the Geographic has made it desirable to have multiple dupes in file for our most used originals. In fact, we decided to make ten 35mm dupes of every slide that is requested for use, before it goes out, and to also duplicate as many slides as we can before they are requested, starting with the slides we think are most likely to be needed. The project is six months old, and will no doubt constitute a whole talk unto itself sometime in future seminars

In the meantime, we are very pleased to have substantially improved the storage conditions of a valued portion of our color slide collection. Our hope is that predictions of extended life of film in cold storage will prove to be accurate, although it's unlikely that any of us will be held to account if they're not.

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