Saving the Irreplaceable Restoration in India

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Saving the Irreplaceable

By Marshall Oliver / Photography by Dr. Atlury Murali
A unique restoration effort, probably the first of its kind ever, has salvaged more than 100,000 historical writings, many from the 17th century, after flash floods hit a library in Hyderabad, India, on August 24, 2000. Restoration of this priceless collection, originally assembled by Mr. Samad Khan, and now owned by a consortium of North American Universities, is nearing completion at the Sundarayya Vignana Kendram (SVK) Library in Hyderabad under the direction of the Canadian subsidiary of Belfor International. The significant work of thermal vacuum freeze-drying and mold remediation has been completed, and finishing details, including straightening and rebinding, are almost complete.

The unprecedented monsoon of August 2000, resulted in severe flooding in Hyderabad with the water level reaching its peak on Thursday, August 24th, when a 15-foot wall of water ravaged parts of the city. At the SVK, the basement windows imploded and within minutes the entire collection was completely submerged. Witnesses reported more than nine feet of mud, water and sewage covering the entire library.

Dr. Atlury Murali, history professor at the University of Hyderabad and a member of the trust governing the SVK, sent an SOS by e-mail to library conservationists worldwide. “I am reporting a tragedy with tears in my eyes,” Murali wrote to James Nye on the evening of August 24. Nye, bibliographer and director at the University of Chicago, represented the consortium which had purchased The Khan collection in 1996. Murali told Nye that the entire collection of over 100,000 books and manuscripts had been completely submerged in contaminated water.

At that time, the books were being catalogued and microfilmed at SVK. Over 100 volunteers and staff

The Gallery entry at the SVK Library in Hyderabad. Every book and manuscript in the 100,000-volume collection was completely submerged in contaminated water.
rubber gloves, boots and masks, and began the task of saving the books.

In Vancouver, Canada, we first learned of the flood when a staff member saw a news brief on the Internet. The conditions at the library sounded grim and there was no apparent solution to their problem. We decided to make inquiries to see if there might be a way for a Canadian company to assist with what appeared to be significant damage to a large collection of irreplaceable books on the other side of the world.

At Cromwell Restoration Ltd. in Vancouver (now a subsidiary of Belfor International) we have made significant inroads in vacuum freeze-drying of paper materials. We had had recent successes with paper restoration projects in Canada, the United States and in Mexico, following water damage and mold infestation. We also had first-hand experience with this type and scale of disaster. While enroute to lead a seminar at the State Farm Insurance Company in Chicago, I stopped at the University of Chicago with my colleague, John Stagl of Belfor USA, where we visited James Nye.

He briefed us on the situation. In Hyderabad, a city of six million people, floodgates had been opened in order to release surplus waters from the Hussain Sagir Aquifer. This had resulted in immediate flooding in many areas of the city. Thousands of families in temporary shelters saw their possessions washed away. Torrents of water turned roads into rivers, and large areas of the city were suddenly waist deep in water. Jim told us the stacks at the SVK Library were completely submerged in less than 30 minutes. Later I calculated that the water must have entered through library windows at the rate of approximately 30,000 gallons per minute, given the size of the gallery.

We learned that responses to Murali’s desperate e-mail had come from Columbia University, Northeast Document Conservation Centre (NDCC) in Maryland, the Library of Congress, the Weissman Preservation Centre at Harvard University, the University of Columbia Libraries, the University of Chicago Libraries, the Association of Research Libraries, the Centre for Research Libraries and the Council of American Overseas Research Centres, as well as from us at Cromwell/Belfor.
The combined advice of experts had been that while the immediate task was to get the books out of the water, it was equally important to prevent the formation of mold due to the humidity level. At the time of the flooding, temperatures approached 100 degrees Fahrenheit in Hyderabad, and relative humidity at the SVK was well over 90 percent. For this reason it was suggested that the books remain under water until arrangements to move them into freezers were fully in place. And it was recommended that once adequate freezer space was arranged, the books and records be placed in wooden or plastic crates in single layers with their spines facing down in order to prevent further damage.

According to the NDCC, paper materials can distort immediately on becoming wet. Paper cockles, inks and pigments tend to run, and coated papers begin to adhere. Mold blooms rapidly in wet collections, first attacking the spines of bound material. Once established, “mold is extremely difficult to control and eradicate... time is of the essence in any recovery operation. The process of stabilization of the collections and the facilities in which they are housed are the key to a successful salvage operation... In most instances, wet books and records must be stabilized by freezing.”

In addition, the NDCC had observed from experience in the last decade in the U.S., “if sound recovery methods are followed, it is less expensive to dry original collections than to replace them.” According to other experts in the U.S., at about 80 percent humidity and at 100 degrees Fahrenheit, mold will grow in about 13 days. At 90 percent humidity and at the same temperature, mold can occur in about four days. And at 99 percent humidity, mold can form within 48 hours. This meant that until adequate freezer space was arranged, the books had a better chance of survival while immersed in water rather than in the hot humid air in Hyderabad.

With modern printing techniques, when coated paper is exposed to water, it can cause inks to bleed or dissolve. The image layer of the coated paper can also be softened, and pages easily adhere when wet. Fortunately, most of the books at the SVK were from the 19th century or earlier, so few would be made of coated paper, and the traditional Indian ink used in most of the publications is not readily soluble. We were more concerned with deterioration of embrittled open-weave vertical grain paper which, if in good condition, would likely withstand prolonged immersion, but if in poor condition, might not survive extended wet storage.

The likelihood of finding over 7,000 cubic feet of vacant freezer space in Hyderabad was slim, so other frozen materials had to be displaced or re-organized to make way for the saturated books. When Murali found what appeared to be adequate storage, the diesel pumps were started. As the water level dropped in the library, books were carefully rescued and washed gently to remove mud and contamination. Slow-flowing water from garden hoses floated away the worst sludge, and books were gently agitated in water-filled tubs. Volunteers took great pains not to further disturb these pages which paid testament to India’s heritage. The delicate condition of the collection meant that books were loaded into crates with extreme care to prevent their falling apart under...
their own weight. Ideally, books are loaded so they are compressed to their original thickness, however this task was virtually impossible since so much swelling had occurred.

Soon the volunteers ran short of crates and the call went out once more for assistance from the community.

That day, the thermometer climbed to 102 degrees. The books were loaded in single rows in each crate, their spines facing down. By the morning of August 26, the first truckloads of crated books were delivered to the freezer.

By the evening of August 30, five days after the flood, the first leg of the recovery operation was over. More than 100,000 books and manuscripts in 2,200 plastic crates had been relocated to cold storage. Of these, three quarters of the load were below freezing (at approximately 28 degrees F.), but due to a shortage of space, the remaining quarter were placed in the only space available at 36 degrees F. These volumes would later prove how readily molds flourish at above-zero temperatures.

The international community of library conservationists praised the salvage operations and actions of the volunteers. Nye described them as “miracle workers.” He contrasted the
successful effort in Hyderabad with a 1966 episode in Florence, Italy, where historical records suffered similar damage in floods. Most of these records were lost forever.

Nye's only bad news that day was his recap of ongoing costs of the reclamation. The consortium was spending over $2,500 (USD) each month for cold storage in Hyderabad with no end in sight, since freeze-drying facilities were not available at any price in India. And the Indian government, in its continuing effort to protect its national heritage, would not permit the books to leave the country.

As we left Jim Nye's office, John and I agreed that the situation in Hyderabad was a unique opportunity for Cromwell to provide a needed service overseas. We believed there might be a way to get involved if we could find a means to inspect the books, develop a funding formula and submit a detailed proposal. Within a few weeks, Nye agreed to cover the cost of airfare if Cromwell would inspect the books without charging a fee. In February 2001, Cromwell made the first of three visits to India.

My companion was Gary Bird, Cromwell's document laboratory manager. Gary's extensive experience with wet paper materials proved to be invaluable, and he became a key member of the India project team. Gary and I had worked together on previous catastrophe responses across the U.S. and Canada, and we were both accustomed to long-distance travel. However, at 30,000 feet somewhere over Greenland, neither of us was quite prepared for the series of events that would unfold in India in the months ahead: examining thousands of mold-infested books, extensive training sessions for volunteers selected to remediate mold, a Cromwell workshop presented to librarians and records managers from across India, lost luggage, culture shock, jet lag, a political uprising, and the beginning of
what would be the restoration of a collection describing a century and a half of Indian life and scholarship.

In the next issue of Cleaning & Restoration, I will detail the restoration processes used to restore 100,000 books over a six-month period. I will describe the ordeals associated with the airlift of 15,000 pounds of equipment from Canada to India, and provide a glimpse at the unstable political climate, which resulted in our rapid departure from India for our own safety at the request of the Canadian Embassy. And of all this occurred during the acquisition of Cromwell by Belfor International.

Much of the detail in this article is a compilation of information by news reporters in Hyderabad. My thanks to a variety of reporters from the Times of India, the Deccan Chronicle, Frontline, the Hindu and other publications reporting the Cromwell/Belfor story throughout India. My thanks as well to Mr. James Elderton, who is presently completing a one-hour documentary of the project for TV distribution in North America, the United Kingdom and India. He can be contacted for further information relating to the film at JamesM Elderton @Netscape.net. This documentary is scheduled to premiere in Savannah, Georgia, this month at the ASCR convention.

A 28-page proposal prepared by Cromwell, which was submitted to The University of Chicago and was used to secure funding for the project can be viewed at http://www.lib.uchicago.edu/e/su/southasia/cromwell_feb_2001.pdf.

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We arrived at Mumbai (Bombay) International Airport at 2 a.m. Once the seal on the aircraft door was broken, we were engulfed by the smells, sounds and overwhelming humidity of India. We had been warned about the hazards that befall tourists in this bustling seaport city and, sure enough, within minutes of our arrival we were duped by a cab driver who successfully demanded an exorbitant fare for a five-minute ride from the international to the domestic terminal, where we would catch the plane to Hyderabad. (Later we learned we could have taken a free shuttle bus.) My associate and travelling companion was Gary Bird, an expert in paper reclamation, who would acquire a taste for Indian food long before the project was completed.

There were no other Caucasians in sight and we were very relieved to finally arrive in Hyderabad and meet our hosts, Dr. Atluri Murali, professor at the University of Hyderabad, and Mr. Sambi Reddy, secretary of the SVK Library Trust, both scolded us for falling for the taxi scam. We liked them immediately.

In the March issue of Cleaning & Restoration, I introduced the SVK Library book-restoration project in Hyderabad undertaken by Cromwell Restoration Ltd. of Vancouver, Canada. On August 24, 2000, immediately following a devastating flood in southern central India, graphic photographs of water damage to 100,000 irreplaceable books and manuscripts echoed across the Internet. These, as well as calls for help, were seen and heard by library conservationists across North America. At Cromwell we had wondered if we might be able to help, and now five months later, here we were on the other side of the world, on our way to inspect the damage.

They received us as if we were royalty, but took great pleasure in telling everyone about the taxi scam. The first order of business was to meet everyone at the library over a cup of strong, sweet tea or chai. We quickly learned that nothing happens in Hyderabad before chai.

Later, we were taken to the cold storage facility. As we entered the coolers, we could scarcely believe our senses. The smell of spicy peppers was overwhelming and within a few minutes our nasal passages were burning. Gary and I took turns sneezing. As we picked our way through all of the different foods, thousands of books came into view, and we were shocked to see well-established mold infestation.

That day we learned that of the collection of 100,000 saturated books, there was only room in the freezers for 80 percent of them. Approximately 20,000 volumes had been stored in the coolers at 36 degrees F. for over six months. That such extensive mold growth could flourish at temperatures...
just above freezing was a real eye opener, and we were reminded that many fungi are extremely hardy and will flourish in a wide range of conditions as long as a food source is present. Our first objective was suddenly clear. With no funding yet available, we had to find a way to initiate a remediation program to prevent further deterioration of the books being ravaged by mold. But first we were required to have more chai.

Next, we inspected the 80,000 frozen volumes. Fortunately, they were in excellent condition, considering they had been submerged in contaminated water, coated in silt and mud, and rinsed with garden hoses to remove surface contaminants. Plus they had been packed into crates designed for a different purpose, and stored in a freezer where rapid air movement continually distributed microscopic particles of dust, spices and environmental contaminants. As we left the coolers, our choice was ice cream or chai.

During the ride back to the library we passed row upon row of shelters made of discarded lumber, tattered tarps and rusted scraps of corrugated sheet metal. These gave no clue that just five months earlier every one of these homes for the homeless had been washed away in the same deluge that had submerged every book in the library.

Minutes later, passing attractive modern high-rise buildings, we were once again awed by the contrasts that make up this fascinating city. While stopped in traffic, a partially clad child approached our open three-wheeled taxi, revealing his disfigured dirty body in hopes that we would be generous with our rupees, yet over his shoulder I could see billboard advertisements flaunting the world's finest electronic wizardry. Incredible!

The next day, we were invited to address about 150 conservationists, librarians and archivists who had gathered from across the region to hear the Canadian message that might save their library. Many were enthusiasts, while others were sceptics. So far this was only talk — while some didn't believe the books could be saved, everyone was able to agree that it was definitely time for chai.

On our return to Canada, we reported our findings to James Nye at the University of Chicago. Jim was, in effect, our client, as he represented the consortium of libraries across North America, which owned the Hyderabad collection. Our finding was that the books could be saved, but only with the aid of a thermal vacuum freeze-dryer. The consortium was already spending over $2,500 USD (100,000 Rupees) each month for cold storage in Hyderabad, with no end in sight. Permanent freeze-drying facilities were not available at any price in India, and the Indian government, in their continuing effort to protect a national heritage, would not permit the books to leave the country. The solution? Ship a vacuum freeze-dryer from Canada, where paper restoration technology is leading the world. Our recommendations were accepted, and the consortium set to work to raise funds to airlift a vacuum freeze-dryer from Vancouver to Hyderabad.

Months passed. The fundraising effort was losing momentum, while in India the library trust members were under sharp criticism over the continuing high expenditure of the freezer rental. Eventually, with other challenges on our horizon, our hopes for a chance to save the books in India began to fade.

Gary Bird reviews the start-up sequence with volunteers responsible for electrical systems maintenance. Constant monitoring was required due to the frequent power surges.

Volunteers move a power transformer into position. Out of necessity the SVK workers became proficient with set-up and operation of every equipment component.

Nervous hands move quickly to complete the myriad of electrical connections. Many electrical sub-systems had to be re-engineered to operate at 50 cycles per second.
**Introduction to Thermal Vacuum Freeze-Drying**

Vacuum freeze-drying or lyophilization is the process of drying frozen materials by sublimation and desorption at low pressure (high vacuum) and at subzero temperatures. Lyophilization cycles consist of three phases: freezing, primary drying, and secondary drying. Freezing wet paper at a slow rate encourages the formation of large ice crystals, which can have a damaging effect on the fibers of wet paper. Rapid air circulation (blast freezing) promotes a faster decline in temperature during the freezing phase, forming smaller, less damaging ice crystals. The process of sublimation is a change of a solid substance directly to a vapour without first passing through the liquid state. During the primary drying phase, sublimation of surface ice crystals occurs. In the secondary drying phase, the moisture diffuses from the matrix of the paper and is desorbed from its surface. New technology permits the use of thermal adjustments to accelerate the rate of sublimation, while maintaining material conditions below the triple point. The triple point of a material occurs when the vapour, liquid and solid phases are all in equilibrium.

Through it all, Cromwell technology was making inroads elsewhere. Recent breakthroughs in our laboratories had brought new possibilities with biocide injection of contaminated paper and experiments with ionization as a restorative cleaning method had produced promising results. These new processes (inspired by founder Dean Russell) were now available at all of our Canadian locations.

In 2002, Cromwell was acquired by Belfor International who, through acquisition, was rapidly becoming the largest restoration group in the world. During these exciting times we were very surprised to receive a call from Jim Nye in Chicago. He had raised the necessary funds, so when could we send a freeze dryer to Hyderabad?

In the wake of the tragedy of September 11th, and the resulting damage to huge quantities of paper, Cromwell and Belfor vacuum freeze dryers in Canada and the U.S. were all filled to capacity. There were backlogs of frozen documents waiting in freezers, so the request from Jim came at the worst of times. Hyderabad would have to wait even longer.

Our documents permitting the importation of equipment from Canada to India were amended over and over again. Negotiations with the government of India dragged on while officials pondered such an unlikely request—to import this odd looking piece of equipment weighing seven and a half tons and measuring 20 feet in length, for a six-month period so that Canadians could save a library. Their lengthy lists of equipment permitted for import did not include a thermal vacuum freeze dryer.

Choosing an aircraft capable of the task, and finding an airport near Hyderabad to receive it were among the many other challenges we faced. Our request to transport the necessary fluids to operate and maintain a sublimation chamber raised official eyebrows. Information about these fluids was requested again and again, and we completed endless forms. Through it all, our new parent began to take note of the project, and after wondering if the Belfor organization would see the same merits that we saw in pursuing the proposal, we were delighted when they embraced the project. And so it became the Belfor project in India.

On May 21, 2002, the Hercules aircraft with its 15,000-pound payload landed in Luxembourg, refuelled and headed for Chennai (Madras) on the east coast of the Indian continent. Escorts from the SVK library were waiting, and after two days of customs inspections, heavy cranes lifted the freeze dryer onto a flatbed trailer, and a convoy began the three-day run overland to Hyderabad. The trip was plagued with vehicle breakdowns and poor road conditions. Later, we learned that during a rest stop along the way, thieves had lightened the load. Fortunately the stolen tools were replaceable.

Due to traffic congestion in Hyderabad, progress was slow. In this city of six-million people, moving a 60-foot truck and trailer through a maze of bicycles and traffic circles, with gridlock at virtually every intersection, was like carrying a piano up a crowded staircase. Traffic police had to be convinced of the merits of allowing the convoy to continue. Mules and carts had to be moved aside to permit our passage. Any hours later the precious cargo arrived at the library, where hundreds of people had gathered to see the strange object hidden beneath protective tarpaulins. More heavy cranes were required. Overhead power lines had to be lifted out of harm's way using handheld bamboo poles. The exterior wall of the library had to be dismantled to create an opening large enough to permit entry of the 1,200 cubic foot cargo.
with frequent blackouts and power surges. For these reasons we were very concerned about the ability of the equipment to operate with any efficiency, and without jeopardizing the equipment itself. Complex power converters and stabilizers were devised for the project, but would they be reliable?

Coincident with our second arrival to install the freeze dryer, the media was giving much attention to the conflicts between India and Pakistan. Each evening, after a long dusty day, we watched the British version of CNN, the only network offering international TV news in English. We anxiously waited for the latest messages from President Bush and UK Prime Minister Blair. Every day the chance of war seemed more likely.

Although we used a cellular telephone programmed for use in India, it would not function in Hyderabad due to disagreements between service providers. Our e-mail link was unreliable, and often we could not make the connection. Occasionally, our hotel operator could secure an overseas telephone line, but the connection often failed.

One night we returned to our hotel to find two messages waiting. One was from Belfor, and the other from the Canadian Embassy. Both messages said . . . “Leave now.”

Thus we were suddenly faced with a new reality. We had to leave the country before our mission was accomplished. Training was far from complete, power supply problems were not resolved, the freeze dryer was not yet operational, and we had to head for the airport. Were we leaving the equipment at risk? What other choice did we have?

After draining cash from every ATM in the neighborhood to get ahead of the exodus of travellers using credit cards, we succeeded in arranging flights home via Dubai and London. We wondered if we would ever see the freeze dryer again.

Once back in Canada, we set to the task of trouble shooting and then operating a thermal vacuum freeze dryer located on the other side of the globe. During the first month we communicated daily and sometimes hourly with Hyderabad, de-bugging the system, solving the operational problems and training the staff. The project had to succeed. Our milestone after solving power supply problems was achieving a vacuum. This was our first indication that the equipment had not been damaged in transit. To celebrate, we made our own chai.

Thinking back, Gary and I didn’t recover from jetlag for weeks, as we often worked through the night to be in contact with Hyderabad, 12.5 hours ahead of us.
The panic call came at 3 a.m. on Thursday morning, when the chamber had been opened after processing the first load. It was 3:30 on Friday afternoon in Hyderabad, and the message received was desperate. There was far too much ice on the condensing coils; it wasn't possible for so much moisture to come out of one load of 3,000 books, so something must be wrong.

That's when Gary and I knew the equipment was fully operational! In our laboratories under controlled conditions, where our vacuum chambers are four times the size of the portable unit in India, we knew that substantial volumes of ice could only be sublimated from wet paper if the equipment was operating correctly. The panic call was music to our ears.

Over a six-month period, the Hyderabad team successfully dried every single volume in the 100,000-book collection, achieving an unbelievable success rate. Volunteers worked in shifts, treating the mold, replacing deteriorated bindings, restoring their heritage for future scholars.

The Belfor India project began as an effort to save books, and ended as a library enhancement project for a rare collection of irreplaceable documents which had suffered years of deterioration and acidification prior to the flooding. After freezing, primary sublimation and secondary sublimation were completed, the library staff performed biocide applications, mold remediation, paper straightening, text block realignment and rebinding under the direction of the Belfor team. Today, the books are being microfilmed and catalogued to conclude a library preservation project unlike any other.

We made our third and final trip to India in late October 2002, after the political scene had settled, and after the freeze-drying phase was completed. We found time for camel rides, elephant rides, wonderful food, a jungle trek and an overnight trip to a remote village where sugar cane and coconuts are harvested. During the trip we reminisced with our newfound colleagues, including Chowdary Lakamansri, a graduate student who became involved (after first saying that the restoration process was a waste of time). Chowdary worked long hours for many months without a break, leading a team to ensure the correct operation of the freeze dryer in Hyderabad. He would phone me from India regardless of the time, and together we would solve operational problems. During the project he has become proficient with paper restoration techniques, and will travel to Vancouver in May 2003, to visit the Belfor Canada facilities.

On our final evening of that last trip, we said our farewells. We dined with the library staff and celebrated our success. One of the highlights was the realization of so many new friendships; another was the sweet, hot chai.

After complex and lengthy export negotiations, we air lifted the unit to Paris, France, where it continues to operate at capacity due to an increase in demand for document restoration in Europe. In fact, as I put the finishing touches to this article while in the air over Winnipeg (on the way home from a flooded library restoration project in Toronto), Gary is over the Atlantic on his way back to Paris to continue training our French technicians. Although our colleagues at Belfor International have identified many applications worldwide for their newly acquired Canadian technology, we wonder if we will ever have an experience to match the challenges encountered and overcome in Hyderabad.

In the previous article I mentioned James Elderton, who has now completed production of a one-hour TV documentary on the project for distribution in North America, the United Kingdom and in India. He has tirelessly documented the Belfor India project for all time. He can be contacted for further information at jamesmelderton@netscape.net. His documentary, “The Hyderabad Project,” premiered in Savannah last month at the ASCR convention. Watch for it on your local cable network.

We are very fortunate to have the support of Cleaning & Restoration and other media to spread our message that now, more than ever, libraries can be saved.

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