

## **IBM 1401 CHM Restoration Project**

Meeting #1, January 16, 2004

Notes by K. Tashev, R. Garner

### Attendees:

- Dave Babcock, Mike Cheponis, Robert Garner, Grant Saviers, Dag Spicer, Kirsten Tashev

### Purpose of Meeting

- Kickoff meeting, arranged by Kirsten, to discuss framework, goals, timeframes, and next steps.

### General Roundtable

- In roundtable order, everyone spoke of their thoughts and expectations for the restoration project, background and familiarity with the 1401, involvement and contributions to date, possible role, and planning suggestions.
- Grant and Mike, with their hands-on 1401 experience, extolled the benefits of getting one up and running.
- There was around-the-table enthusiasm for a “1401 operational exhibit”, as it will make for an impressive, engaging, and classic visitor experience. A re-born, operating 1401 system, with its dramatic, old-style mechanical peripherals would bring to life the visceral sounds and sights of a 1960’s computer room, including:
  - o Punch cards speeding by at 800 per minute (13 cards/sec!),
  - o A chattering line printer at a swift 600 lines/min (10 lines/sec!), and
  - o Whirling reel-to-reel 9” tape drives (10 feet/sec).
- One observation was that the 1401, as the workhorse of the business/EDP industry in the 60’s, could attract Museum visitors from new sources (beyond the traditional scientific and engineering backgrounds).
- There was some discussion on how frequently the 1401 and its peripherals could reasonably be operated. The difference was noted between keeping it running “at all costs” (potentially using newly manufactured replacement parts) versus repairing it with only authentic parts (e.g., “new old stock”, or perhaps swapping parts with the Museum’s existing, less-complete 1401.) Also, how many years could the 1401 realistically be expected to operate and be maintained?
- Robert mentioned that IBM Almaden Research had agreed to underwrite the land and sea transportation charges from Germany.
- It was noted that the 50<sup>th</sup> anniversary of the IBM 1401 product announcement occurs in Oct. 2009.

### Summary of the machine:

- The 1401 was operated in Germany and decommissioned and stored in a personal, enclosed garage in Hamm, Germany about 15 years ago, by its long-time field engineer (FE), Arnold Schweinsberg. It was inspected, photographed, and found to be in excellent shape in Sept. 2003. It was manufactured in Stuttgart, but we do not yet know its full history. (The runtime meter shows 88,730 hours, or 10 years.)
- A summary of what has been procured:
  - o 1401 Processing Unit
  - o 1402 Card Reader / Punch
  - o 1403 Chain Line Printer

- 1406 Core Storage
- 729 Reel-to-Reel Tape Drives (5)
- 077 Collator
- 083 Sorter
- 129 Card Punch
- Tape Drive Tester
- Large set of spare SMS circuit board cards and mechanical parts
- Schematics, maintenance drawings, documentation.
- Estimated date of arrival in California is early March.

#### Initial thoughts towards a running machine:

- The German field engineer, Arnold Schweinsberg, asked if he could travel to the Museum to help get the 1401 and its peripherals up and operating. The Museum agreed and the budget includes per diem fees for Arnold and his son, Rolf. (Both capable English speakers.)
- There was consensus that it will be necessary to find and recruit local, ex-1401 field engineers to assist with ongoing maintenance.
- Suggestion was made to contact Paul Pierce, who owns a 1401 in Seattle.
- We'll need to develop a test and bring-up plan, including the initial test of parts and subsystems. The peripherals will require adroit mechanical skills. (For instance, the 1403 print chain moves at 7.5 feet a second! Also, rubber captains on tape drives disintegrate with age and may need to be reformed, including "vulcanization.")

#### Power Conversion

- This 1401 was designed for European 380 V, three-phase, (220 V single-phase), 50-Hz power.
- Estimated max total power consumption is 15 - 20 kW (70 - 100 A at 208V).
- Grant has explored options for converting to our 208 V, 3-phase, (120 V single-phase) 60-Hz power. As the 1401 peripherals contain mechanical components that assume a 50-Hz line cycle, this is a critical item to address. Options for converting power include:
  - Procure an electrical motor generator set. Grant has a quote from a vendor. Lead-time is 3 months, cost estimate \$8K.
  - Procure a UPS battery unit.
  - Procure a switching "inverter". Quality of AC may be an issue.
  - Convert or adjust mechanical devices for 60-Hz and, if 1401 power supplies were so designed, re-configure/re-jumper them for 208V/60-Hz. (This option appears least likely for motors. For instance, the runtime meter is a 50-Hz device.)
  - A hybrid solution: Motors and necessary mechanical devices are operated at 50-Hz, and 3-phase power supplies are re-configured for 208V/60-Hz.

#### Placement and Layout:

- Current plan is to locate system in the raised-floor, 1<sup>st</sup>-floor, server room. This location is near the end of current visible storage area tours.
- Grant & Mike outlined a 1401 machine room layout. Our layout will need to take into account how to best position an operational system for the visitor experience. The layout will also need to take into account cable and power restrictions.

#### Exhibit/Program Ideas:

- Will need to begin considering applications or demo programs that we could run that will be interesting to visitors.
- Would be great to have something that a visitor could take away with them (e.g., printout, card, etc.)
- Will want to schedule a workshop on operating and programming 1401.

#### Initial plan for labor requirements, including long-term support:

- Project leader (R. Garner).
- Restoration Team
- Operators
- On-going Maintenance/FE
- Trained Docents
- Exhibits
- Software & Documentation Preservation, Web Presence

#### Schedule/Project Outline:

- Create a bring-up, maintenance, and exhibit plan,
- Establish the team, and
- Establish web site including links to online resources. (2-3 months)
- Inventory parts, subsystems, software, documentation (2-3 months)
- Subsystem and system bring-up (3-6 months)

#### Next Steps:

- RG – Search for 1401 Field Engineers, others with 1401 experience (including the local IBM retirees, Paul Pierce, etc.), and volunteers in general.
- GS – Continue to investigate and report on a power conversion solution.
- MC – Setup a 1401 web site and mailing list. (using [www.1401.org](http://www.1401.org) ?)
- RG – Draft a project plan with input from members and set-up the next meeting (Wednesday afternoons are a good meeting time for the current group.)
- RG – Identify person to be responsible for initial server room layout, using IBM system planning documents and drawings of our server room (from M. Falarski).
- RG – Work with Mike to establish plan for preparing server room and receiving and unpacking 1401 shipping crates.

# IBM 1401 Restoration Project

Meeting #2, February 11, 2004

Summary by R. Garner

## Attendees:

Dave Babcock,  
Mike Cheponis,  
Mike Falarksi,  
Robert Garner,  
Eric Smith,  
Dag Spicer,  
Kirsten Tashev

## Unable to attend:

Rhonda Farrell  
Grant Saviers

## Purpose of Meeting:

- Delivery & logistics update, server room layout & tour, power & 50-Hz conversion status, email/web site, recruiting help, documentation and accessioning.

## Meeting Minutes:

- Delivery & logistics update: Mike has spoken with Rolf. 1401 shipping freight crate had been picked up. However, according to IBM's Stefan Braun, shipment from Germany has been delayed. Mike has made arrangements for receiving crate, unpacking, and moving contents into server room. Mike needs the BOL ("Bill of Landing"); i.e., itemized contents of crate. We discussed whether the "unit record card handling equipment" (077 collator, 083 sorter, 129 punch) would initially be placed in the server room or not. There was a question as to the 1401's export valuation and how much we'll be charged.
- A/I – Mike F – Ask for BOL & updated delivery information from IBM's Stefan Braun. Also verify identity of custom's agent when shipment arrives in Oakland.
- A/I – Robert – Check with Braun on 1401 export valuation.
- Server room: Mike discussed server room and its capabilities. Handed out copy of server room floor plan (also emailed). There is generous space for the placing the 1401 equipment, and more than sufficient power and air conditioning (A/C). Noted that Museum volunteers would be cleaning its floor upcoming weekend, 2/14. Robert noted that Rhonda Farrell has agreed to produce an initial server room floor plan and placement. After the meeting adjourned, several of us inspected the empty server room, noting placement of two large "Liebert System 3" A/C units and an "EPE Technologies EPS-2000 Data Power System". One of the Liebert systems is currently continuously operating (at 70 C).
- A/I – Rhonda – Initial server room layout with 1401/2/3/6 and card units.
- A/I – Mike F – Locate any documentation associated with Liebert and EPS-2000 power systems.
- Heat, Power, A/C summary:
  - Total max 1401 system power estimate is about 14 kVA:
    - 1401/2/3/6 system ( 4.5 + .4 ) ≈ 5 kVA

- Five 729 tape units @ 1.6 kVA each = 8 kVA, and
    - 077 / 083 / 129 card “record handling equip.” = 1 kVA ?.
  - Power delivery in to room is about  $275A * 480 V = 132 kW$ . From Mike:
    - > The main panel into the 1401 Restoration Lab is a 400A,
    - > 480Y/277v, 3ph, 4w panel with an original Total Connected
    - > Load of 380A and Total Demand Load of 275A. The EPS2000 is
    - > on a 250A breaker. The 2 position (UPS<>PG&E) switch for
    - > the EPS2000 distribution panel is protected by a 200A
    - > breaker.
  - A/C Summary: Two Liebert System 3 units at 19 tons each. Under ideal conditions, both of them could cool  $38 * 3500 = 133 kW$ . We clearly will only need one operating for the entire 14 kW 1401 system. Second unit could be utilized as a spare (or possibly removed or repositioned in room?)
- Discussed options of motor generator vs. attempting to convert the system to operate on our 60 Hz power. Noted Mike F’s quote (\$25k for a 50 kVA solid-state frequency converter from Visicomm) vs. Grant’s quote for a motor generator set (\$9.2k for 28 kVA, 14-week delivery). This is a complicated, technical issue and difficult to properly address without documentation for our particular 50-Hz 1401 system. Challenges of trying to run the system directly on our 60-Hz power include ferromagnetic transformers in the main power supplies (in 1402) and possible synchronous motors in 729 tape drives and 1402/03 and card equipment.
  - A/I – Eric – Evaluate the plausibility of running the system directly on 60 Hz. Which motors or transformers, if any, may need to be replaced.
  - A/I – Mike C – Ask for Rolf’s recommendation on 60 -> 50 Hz conversion.
  - A/I – Grant – An updated quote for lower-power motor generator. Can we get quotes from several vendors?
  - Kirsten discussed the upcoming accessioning of our 1401 materials: The receiving, inventorying, and cataloging of all the hardware, software, and documentation artifacts. She expected that this will take several months. There was a desire to get everything scanned as soon as possible. Especially to get copies made of important docs we’ll be using during restoration work. Dag volunteered to gather and locate the Museum’s 1401 documentation together in one place (probably a cubicle for easy access). Dag also volunteered to setup an accessioning framework for the 1401 project. (However, this may be in conflict with his other Museum responsibilities.) Once Dag has a framework setup, Mike C volunteered to enter the document info into the Museum’s database (DBTextWorks). Mike also indicated he has a fair amount of 1401 documentation he can make available to the project.
  - A/I – Dag – Collect 1401 docs in a cubicle and setup 1401 accessioning framework in DBTextWorks.
  - A/I – Mike C – After Dag is ready, enter the Museum’s current 1401 docs into DBTextWorks.
- Discussed our need to recruit help, especially to locate former IBM 1401 Customer or Field Engineers. Discussed when Rolf & Arnold should come to help with bring up. Decided that this could be after system is inventoried and ready to power up. (For instance, capacitor reformatting can take place before they arrive.)

- A/I – Robert – Contact Paul Pierce (has a 1401 in his collection), Van Synder (1401 web site's list of names), Gordon Bell, Bill Selmeier's contacts, and San Jose IBM Retirement Club ([www.sjpc.org/sjrc](http://www.sjpc.org/sjrc)).
- Discussed setting up a project email alias and web site. After some discussion, decided it would be beneficial to have a publicly accessible project web site, primarily as a recruiting aid and to help publicize Museum activities. However, decided to not yet seek out volunteers on large discussion groups, such [www.classiccmp.org](http://www.classiccmp.org). Dag volunteered to setup an email alias [1401\\_team@computerhistory.org](mailto:1401_team@computerhistory.org). Dag would also like to do a simple web site for project.
- A/I – Dag – Setup 1401 project email distribution list and a simple web page.
- A/I – Robert – Email out his handful of 1401 web links for web site.
- A/I – Mike C – Finish scanning 1401 photos taken in Germany by Heinz.
- Noted that April 7<sup>th</sup> is a joint IBM/CHM event regarding IBM 360 family 40<sup>th</sup> anniversary. October of this year is 45<sup>th</sup> anniversary of 1401 announcement (1959).

# IBM 1401 Restoration Project

Meeting #3, March 12, 2004

Summary by R. Garner

## Attendees:

Mike Cheponis,  
Tim Coslet  
Mike Falarksi,  
Rhonda Farrell  
Robert Garner,  
Ted Johnston  
Reinhold Lohkamp-Schmitz  
Dag Spicer,  
Kirsten Tashev  
Mike Zahares

## Unable to attend:

Grant Saviers  
Eric Smith  
Dag Spicer

## Purpose of Meeting:

- Delivery & logistics update, server room layout & tour, power & 50-Hz conversion status, email/web site, recruiting help, documentation and accessioning.

## Meeting Minutes:

- Delivery & logistics update: As we met, the Duesseldorf Express container ship had just moved into Oakland under the Golden Gate Bridge! Expected delivery date is Weds, March 17<sup>th</sup>, with unloading on Thursday the 18<sup>th</sup>. Mike Zahares of TransTechnology Group (“Transportation and Exhibit Services for Technology”) is ready for the all-day uncrating and unpacking. Plan is to have a cargo truck at the dock to act as a holding station for the packing materials. We’re not sure how long our container will be held in Oakland customs before transport to San Francisco and then to our loading dock by Eagle Freight Services, IBM’s import broker.
- Robert – Check with Alan Taber, of IBM San Jose Global Logistics Group, who is coordinating customs for us.
- Server room: Rhonda, Mike C., and others worked together to update the floor plan. We settled on a plan we were all happy with. We toured the server room at the end of the meeting. Mike Z had a spreadsheet showing the depth of the 1401 at 48 inches, and with the server entrance steel-frame door at 47 inches wide, we thought we had a serious issue! Measuring the 1401 in Visible Storage resolved the problem—It’s actually 32” deep.
- Heat, Power, A/C: Mike F does not want to move the second Liebert unit (not needed to cool the 1401). However, we noted that the running Liebert seems to be making too much noise (rumbling, grinding). Perhaps it needs some attention?
- Mike F – Is there an opportunity to check with Liebert maintenance whether the 20-ton “System 3” unit is making too much noise?

- Mike F – Locate any documentation associated with Liebert and EPE Technologies EPS-2000 Data Power System.
  - As Grant and Eric were not at the meeting, we did not discuss the 50-Hz conversion issue, but to summarize it. We also noted that we need to check the system's schematics regarding ferro-magnetic power supplies (in 1402) and possible synchronous motors in 729 tape drives and 1402/03 and card equipment.
- Grant – An updated quote, specs, and pictures for new 15 kVA and 20 kVA motor generator sets. Any used units on the market?
- Kirsten discussed status of accessioning: The receiving, inventorying, and cataloging of all the hardware, software, and documentation artifacts. She noted that a cubicle has been established for holding the Museum's current 1401 docs. We emphasized the need to get copies made of important docs we'll be using during restoration work. Not clear what best way to get copies made is? Dag volunteered to gather and locate the Museum's 1401 documentation together in one place (probably a cubicle for easy access). Dag also volunteered to setup an accessioning framework for the 1401 project. (However, this may be in conflict with his other Museum responsibilities.) Once Dag has a framework setup, Mike C volunteered to enter the document info into the Museum's database (DBTextWorks). Mike also indicated he has a fair amount of 1401 documentation he can make available to the project.
- Dag – Setup 1401 accessioning framework in DBTextWorks.
- Mike C – After Dag is ready; accession the Museum's current 1401 docs.
- Kirsten – Process for getting photocopies made of new docs and schematics.
- Robert discussed status of searching for volunteer help in restoring the hardware, in particular retired IBM Customer or Field Engineers. He has submitted a short notice to run in the IBM Retirement Club Newsletter ([www.sjpc.org/sjrc](http://www.sjpc.org/sjrc)). Van Synder has been contacted and added to our email alias. We will try to recruit volunteers at the 360 40<sup>th</sup> anniversary event on April 7<sup>th</sup>.
- Robert – Contact Paul Pierce (has a 1401 in his collection) and German Museum with 1401 ([www.1401team.computerhistory.org](http://www.1401team.computerhistory.org)).
- [1401\\_team@computerhistory.org](mailto:1401_team@computerhistory.org) has been setup by Mike Walton.
- Dag – Setup Museum's 1401 restoration web page.
- It was noted that a bring-up plan is needed!
- Robert – Write-up and distribute for comment the 1401 bring-up & restoration plan!



# IBM 1401 Restoration Project

Meeting #4, April 02, 2004

Summary by R. Garner

## Attendees:

Mike Cheponis,  
Mike Falarksi,  
Robert Garner,  
Dag Spicer  
Eric Smith  
Grant Saviers  
Dick Weaver

## Agenda:

- 50-Hz conversion options
- Appraise the newly arrived 1401 system!

## Meeting Minutes:

- The 1401 shipment arrived at the CHM's loading dock on Thursday, March 18<sup>th</sup>. Mike Zahares and crew skillfully unpacked it the next day and arranged the units according to our floorplan. It looks fantastic! Although some of the units (1402, 729) have some dirt, grime and rust, it all appears to be good shape for its age, especially the CPU unit.
- Mike F followed up with Liebert maintenance and they repaired the 20-ton "System 3" air-conditioning unit, so that it no longer produces an obnoxious rattling noise.
- The entire meeting was spent discussing our 50-Hz conversion options. The major conversion options are:
  - Purchase and install a 50-Hz motor generator set.
  - Purchase and install a 50-Hz solid-state static power converter.
  - Modify the 1401 to operate at 60 Hz. Looking at the machine's documentation, it looks like it had been converted from 60 to 50 Hz in Europe. Challenges include several ferro-resonant power supplies in the 1402, and some AC motors in the 1402, 1403, and 729 (although labeled 50-Hz, not sure if they are synchronous). One option would be to swap components, such as power supplies, with the 1401 the museum already has (if the museum approved).
  - Determine whether the UPS (MGE EPS-2000 Data Power System) can be converted to 50-Hz operation. Would also need to confirm that the building's other items powered by the UPS feed (i.e., servers and emergency lights) properly operate at 50-Hz power.

- Grant presented information on the tradeoffs on the motor generator and solid-state converter options. In addition to the raw specs, other items to consider include the need for a sound enclosure, location and cooling of the unit, and motor load startup demand. Some of the motor generator sets would be quite loud and probably should not be located in the server room with the 1401, even with a sound enclosure, which may also effect the cooling of the unit. If in another room, then cooling of that room and getting power to it becomes a construction/building code issue too. Delivery, availability, maintainability, used vs. new, and difficulty in operating are additional considerations.

These are the primary options discussed in the meeting (MG = Motor Generator):

1. Solid-state, static converter
2. MG: 60-Hz-induction motor to 50-Hz synchronous generator, V-belt
3. MG: 60-Hz-sync motor to 50-Hz sync generator, cog timing chain
4. MG: 60-Hz-induction motor to 50-Hz sync gen, direct-coupled
5. MG: 60-Hz-sync motor to 50-Hz sync generator, direct-coupled

The discussion resulted in this table of approximate-to-estimated features, specs, characteristics, and estimated costs. For costing, heat generation, etc, we're assuming the max anticipated power load of 12.5 - 12.9 kVA (all five 729's and 1401, 2, 3, 6 running).

Feature	1) Static	2) MG-Ind/Belt	3) MG-Syn/Cog	4) MG-Ind/DC	5) MG-Syn/DC
Cost/kW	\$ 1000	\$ 660	\$ 640	\$ 300	?
Cost (New)	\$ 12.5 k	\$ 8.2 k	\$ 8.0 k	\$ 3.9 k	?
Size	4 ft3	2'x3'x4'	2'x3'x4'	2'x3'x4'	2'x3'x4'
Noise @ 3 ft	60 dBA	80 dBA	85-90 dBA	70 dBA	70 dBA
Efficiency	88 %	75 %	75 %	75 %	75 %
Heat generated	2.9 kW	3.3 kW	3.3 kW	3.3 kW	3.3 kW
Freq Accuracy	.001 Hz	±2 %	.01 Hz (PG&E)	2.5 %	.01 Hz (PG&E)
EMI/RFI	?	Low	Low	Low	Low
Install Cost	Smallest	Large	Largest	Medium	Medium
Service Cost	No	Yes	Yes	Yes	Yes

- Although option #1, the static converter is most appealing from an ease of use, noise, accuracy, reliability, install ability, and maintainability perspective, it is most expensive. The other interesting option in this table is #4, the direct-coupled, induction motor generator set. However, these MG sets come from an outfit in Brazil, with a long lead-time of 14 weeks. It would be good to review the actual specs (what makes them cheaper?) and look for a quote from a second source. Also, what about used static inverters and MG sets?
- Grant – Look for a 2<sup>nd</sup> quote on a direct-coupled MG set.

- Explore other options and prices for used units.
  
- Other open A/I's:
  - Robert – Bring-up & restoration plan.
  - Kirsten – Accessioning and availability of museum's current 1401 docs. Accessioning of the new 1401 docs.

# **IBM 1401 Restoration Project**

Meeting #5, June 4, 2004

Summary by R. Garner

## Attendees:

Sharon Brunzel  
Mike Cheponis  
Mary Cicalese  
Tim Coslet  
Mike Falarski  
Bill Flora  
Robert Garner  
Jack Grogan  
Ted Johnston  
Chuck Kantmann  
Frank King  
Glenn Lea  
Allen Palmer  
Dick Perkins  
Grant Saviers  
Dag Spicer  
Kirsten Tashev  
Ed Thelen  
Ron Williams

## Agenda:

- Introduction of the new, retired-from-IBM volunteers
- 50-Hz power status (including UPS option)
- Bring-up plan discussion
- Organization of unit restoration teams (w/ separate meeting times)
- Accessioning activities
- Web site status

## Meeting Minutes:

- The recent outpouring of ~15 retired, local IBM'ers who maintained 1401's as Customer Engineers, Field Engineers, or Technicians is an auspicious start for our restoration project! The response to the "An IBM 1401 Needs Help" ad in the May & June San Jose IBM Retirement Club Newsletters and a San Jose Quarter Century Club (QCC) bulletin has been fantastic. Special thanks go to Walt Cole, Retirement Club Newsletter editor, Jack Grogan, and Bill McDonnal. Photos, biographies and 1401-era backgrounds of each new 1401-era team member were distributed and are online at project web site address (below).

- Grant summarized the status on the 50-Hz conversion issue. His opinion is that we could get a smaller 60→50 Hz converter sized for a subset of the entire max name-plate load (i.e., 1401/2/3 @ 4.5 kVA instead of everything at 13 kVA), so we could bring subunits up at 50-Hz, and then, later, possibly re-engineer them to run at 60-Hz. (Note that a 729 tape nameplate is 1.6 kVA each.). He also indicated he may just purchase the \$500 motor generator set that is available.
- R. Garner – Explore procuring a 60→50 Hz, 3-phase solid-state “inverter” rated at 4.5 kVA for the core of the system. (One question: Motor startup load?)
- Grant – Look for a 2<sup>nd</sup> quote on a direct-coupled motor-generator set.
- Mike Falarski reported that the UPS representatives (from MGE) stated that they are not willing to convert our current UPS installation to 50-Hz operation.
- Regarding the system bring-up plan, we agreed to break the project into four, concurrent mini-projects, each focused on a major subsystem. Each subsystem has a lead, who will be responsible for bringing together their sub-team, writing a bring-up plan for that sub-unit, and arranging meeting times, etc.. Each lead will be issued a museum access badge (after a short training session on the facilities). We will also maintain the overall group meeting too. The subunit leads are:
  - 1401 CPU – Ron Williams, (408) 269-1281, <no email yet>
  - 1402 Reader/Punch – Bill Flora, [billflora@comcast.net](mailto:billflora@comcast.net)
  - 1402 Printer – Frank King, [kingcc@attglobal.net](mailto:kingcc@attglobal.net)
  - 729 Tape Unit – Allen Palmer, [aj.palmer@mindspring.com](mailto:aj.palmer@mindspring.com)
- Robert – Coordinate a time for facilities/access class by Mike Falarski.
- Other bring-up items discussed included:
  - Whether to share the PDP-1 Restoration Lab space for subunit bring up (such as the 729 tape drive). Decision was NO (tool/test equipment sharing conflicts, etc.)
  - The fact that the Museum does not supply test equipment, scopes, etc..
  - The need to wear gloves when handling the visible surfaces of the artifacts to prevent skin acids from (eventually) degrading the surfaces. (Touching and handling of internal components is OK.) There was some spirited discussion on the Museum’s policy to not clean externally visible surfaces. (It was noted that this unit was stored in a garage for ~15 years.)
  - Approaches to initialize core main memory in the CPU. Will the 1402 card reader be up before or after the CPU itself? Mike Cheponis related how a laptop is used to read/write memory on the PDP-1. When the 1402 is up, will need a punched card stock.
  - All of the documentation will be photocopied, punched cards, and reel-to-reel tapes will need to be duplicated for day-to-day handling and use. Two copies will be made of the documentation: One master on acid-free, archived paper, and a second master, itself for making additional-use copies. Mary is looking for volunteers to help with the photo copying! Originals will also be scanned, of course.

- Mike Cheponis noted that, even though the Liebert had been repaired, the server room is still noisy as a place to work and light levels are low. Mike Falarski suggested that the Liebert could be turned off as necessary (while units are unpowered, of course.)
- Mike Falarski – Verify if overhead lights in server room need maintenance. Also, is humidity (and temp) within range and monitored?
- Kirsten & Dag noted that the Museum’s collection of 1401 documents had been placed in a single cubicle for easy access. Sharon and Mary are ready to begin inventory of the project’s 1401 documentation. (Although the new accessioning framework, DBTextWorks, may not be ready yet.) . Mary offered to ask Allison Akbay to give a class on the proper handling of computer system artifacts.
- Mary – Organize a class by Allison on sensible handling of computer artifacts.
- Frank King suggested a meeting to begin to get a handle on what all came with the system (cables, spares, cards, tapes, etc.). Inventory meeting scheduled for Friday, June 11<sup>th</sup>, 9 – noon. Mary will be there to help with inventory.
- Ed Thelen volunteered to start a 1401 project web site, now up at:  
<http://www.ed-thelen.org/1401Project/1401RestorationPage.html>
- Dag – Move the 1401 web site to Museum’s site. (Use wiki server too?)
- Before the meeting started (and afterwards), Robert Garner, Frank King, Chuck Kantmann, Jack Grogan, & Tim Coslet moved the 1401 cables to under the raised floor to move them out of the way. (The server room floor surface will be cleaned by the weekend volunteer crew.)
- Next meeting scheduled for Weds, June 16<sup>th</sup>, 11-1pm. (Selection criteria: Morning times, to avoid rush hour in the afternoon, and over lunch, as some folks still have full-time jobs. Sub-unit teams will be free to establish their own, convenient work hours.)

# IBM 1401 Restoration Project

Meeting #6, June 16, 2004

Summary by R. Garner

## Attendees:

Mary Cicalese  
Tim Coslet  
Mike Falarski  
Glenn Furlong  
Robert Garner  
Alex Hurwitz  
Chuck Kantmann  
Frank King  
Glenn Lea  
Don Luke  
Ron Mak  
Dan McInnis  
Allen Palmer  
Dag Spicer  
Ed Thelen  
Ron Williams

## Agenda:

- Introduction of new volunteers
- Dag Spicer on Museum restoration philosophy, procedures, rules, & safety
- Bring-up plan organization
- 50-Hz power
- Accessioning
- Facilities
- Web site

## Meeting Minutes:

- We're now up to ~20 local, retired, ex-IBM volunteers who maintained 1401's as Customer Engineers, Field Engineers, or Technicians many years ago. We will need to record everyone's stories and memories! It was noted that ten of the volunteers are 1401 programmers, and we'll want to organize lectures/classes in that subject.
- Ron Mak – Coordinate 1401 software classes, seminars, instruction.
- Dag gave a presentation, soon to be on the 1401 web site, on the Museum's restoration philosophy (why restoration?, expert help on restoring finishes), handling procedures (reversibility), transparency (log books, document everything, photos), conflict resolution, and safety (high voltages, CPR, defibrillator). Dag will be asking everyone to sign a Pledge form to abide by the procedures. It was decided we will organize a CPR and First Aid class for at least 3-4 certifications.

- Mary – Organize CPR and First Aid class.
- Dag – Distribute and ask volunteers to sign a Pledge to adhere to the Museum’s restoration rules, regulations, and procedures. Present again at next meeting for those who missed this meeting.
- We had a spirited discussion on record keeping and how to organize the log books: Whether to have just one system log book, log books for each unit, or both. We eventually agreed to do both: A master system log book and one log book for each unit, for five total: System, CPU, Reader/Punch, Printer, Tape.
- We discussed a process for a bring-up plan. Each unit leader will be responsible for a unit-specific bring-up plan. Although there will be common items between all, such as capacitor reforming, it is expected each unit bring-up plan will have unique requirements. (For instance, the printer can be hand cranked and the tape drives have vacuum columns.) We will have a group meeting of the unit leads plus a rep from PDP-1 and/or 1620 projects. We nominated Chuck to be the system integration group leader. Chuck will also be our primary contact with Arnold Schweinberg, the machine’s original CE.
- R. Garner – Explore procuring a 60→50 Hz, 3-phase solid-state “inverter” rated at 4.5 kVA for the core of the system. (One question: Motor startup load?)
- Mike Falarski.....
- Mike Falarski – Verify if overhead lights in server room need maintenance. Also, is humidity (and temp) within range and monitored?
- Kirsten & Dag noted that the Museum’s collection of 1401 documents had been placed in a single cubicle for easy access. Sharon and Mary are ready to begin inventory of the project’s 1401 documentation. (Although the new accessioning framework, DBTextWorks, may not be ready yet.) . Mary offered to ask Allison Akbay to give a class on the proper handling of computer system artifacts.
- Mary – Organize a class by Allison on sensible handling of computer artifacts.
- Frank King suggested a meeting to begin to get a handle on what all came with the system (cables, spares, cards, tapes, etc.). Inventory meeting scheduled for Friday, June 11<sup>th</sup>, 9 – noon. Mary will be there to help with inventory.
- Ed Thelen volunteered to start a 1401 project web site, now up at:  

<http://www.ed-thelen.org/1401Project/1401RestorationPage.html>
- Dag – Move the 1401 web site to Museum’s site. (Use wiki server too?)
- We noted that the server room floor surface is now wonderfully clean. A father/son volunteer did a great job.
- Next meeting scheduled for Weds, June 16<sup>th</sup>, 11-1pm. (Selection criteria: Morning times, to avoid rush hour in the afternoon, and over lunch, as some folks still have full-time jobs. Sub-unit teams will be free to establish their own, convenient work hours.)



# IBM 1401 Restoration Project

Meeting #7, June 30, 2004

Summary by R. Garner

## Attendees:

Allison Akbay  
Sharon Brunzel  
Mary Cicalese  
Tim Coslet  
Dave Cortesi  
Don Cull  
Mike Falarski  
Bill Flora  
Robert Garner  
Chuck Kantmann  
Frank King  
Don Luke  
Dan McInnis  
Fred Oehm  
Allen Palmer  
Bill Selmeier  
Ed Thelen  
Dick Weaver  
Ron Williams

## Agenda:

- Introduction of new volunteers
- Facilities status
- Report from last week's meeting with IBM archivist.
- Status of Unit bring-up plans (Ron, Bill, Frank, Allen, Chuck)
- 50-Hz power
- Inventorying and accessioning status
- Web site
- At noon - Allison Akbay on techniques of artifact handling

## Meeting Minutes:

- Two new 1401 team members introduced: Don Cull & Dave Cortesi. Bill Selmeier indicated that everyone should register on the new volunteer web site, <https://www.computerhistory.org/volunteer>, and to log past and upcoming volunteer hours. (The 1401 volunteer hours logbook will no longer be used.)
- Bill S – Send pointer & instructions on using new volunteer web site to alias.

- Dag – Distribute a procedures & safety pledge form for all to sign. Present Museum’s restoration safety and procedures again for those who missed 1<sup>st</sup>.
- Mary – Organize a CPR and First Aid class.
- Mike F indicated that fluorescent lights are ordered and would like us to plan which floor tiles need holes (so that he can remove those not needed for safety).
- Discussed the project’s expense fund and spending rules. It was agreed that the group would need to pre-approve any purchase over \$100. Also discussed eBay bidding for project materials. It was suggested that if someone is eBay bidding on a 1401-related item that they let the alias know. (Looks like we will not need punched cards as Museum has sufficient stock for now.)
- Robert – Propose a reimbursement procedure against the project expense fund.
- Robert reported on the 6/23 meeting with IBM’s official archivist, Paul Lasewicz, and IBM San Jose’s (just-retired) historian, Dave Bennet. Paul indicated that IBM has very few artifacts from before early 70’s, especially software or documentation. We asked Paul to look for following items: any 1401 docs, esp. “parts catalogs” a.k.a. manufacturing assembly diagrams; 1401 films and photos; leads to any satellite “repositories” (such as the Germany repository, but tragically lost to a fire).

Dave Bennet suggested we also contact the other known active IBM Quarter Century Clubs (Boulder and Tucson); contact IBM Fellow Ric Bradshaw in Tucson, and Jim Wiedenhammer (worked on 729 vacuum system); & contact Henry Harvel, parts distribution (in Mechanicsburg, NY?)

- R. Garner & Dave Bennet – Try to find IBM contacts above.
- Lively discussion on bring-up plans & 50-Hz power. Three bring-up plans have been written and will be posted on the project web site as soon as Chuck reviews them. Unless an inexpensive, 13 kVA 60->50 Hz power converter falls from the sky, there are several possible options.

(A) There is a proposal that the 1401/2/3 & single 729 on display in the Museum’s visible storage (VS) might be in better physical condition and thus a better machine for restoration (assuming we get the Museum’s permission!). However, on closer examination (at 6/23 unit lead meeting), it was noted that the VS 1401 CPU backplane wiring is brimming with “red” wires, which, according to Frank, indicates significant field alterations. Also, the VS 1401 CPU’s cables are all cut off at entry to the frame and its front panel was monkey’d with. We’re also not certain we have its schematics and documentation. So the general consensus is to stick with the German 1401 CPU for restoration. However, the VS 1402 card reader/punch (esp. card handling path) and 1403 printer (esp. cover and panel indicators) are physically cleaner and less rusty and moldy than the German 1402/3 (and are 60 Hz).

One major roadblock to the idea of using the VS 1402/3 is whether it is technically possible to mix the VS 1402/3 with the German 1401 due to different supported features (729 model “intermix” feature in German 1401, “early read” feature & different visible logics in German 1402, Ramac interface in VS 1401, etc.) Second problem is that VS 1401 serial number is #20,597, which, according to Paul Pierce, is before major logic and signal changes at serial #25,000. Our German machine is serial #28,421, after the major changes. This implies the VS 1402/3 is incompatible with our more recent German 1401 CPU.

(B) Another option to address the power issue is to swap the 60-Hz ferro-resonate power supplies in the VS 1401/2 with those in our 50-Hz German machine. (Assuming we can secure the Museum's permission!) This assumes the ferro-resonate power supply connector pin outs and voltages are the same (which may not be because of the changes after serial #25,000). This should allow us to run the 1401/2/3/6 complex at 60 Hz.

There is some indication that the 729 tape drives could be successfully run at 60 Hz. The 729's synchronous and induction motors should operate OK at 60 Hz and the different speed of the reel motors should not be an issue with the vacuum-column based controls.

(C) Another option is to run the 1401/2/3/6 complex at 50 Hz from a converter and the 729 tape drives at 60 Hz. If the 729's can be operated at 60 Hz, one could procure a 5-kVA static converter for just the 1401/2/3/6 complex. (Assuming there is no AC power from the 1402 to the 729's.) This option is most straightforward, as we would not need to touch the units in visible storage, and the cost is reasonable (~\$5K for new static converter.) To meet electrical code, we would need to have a single on/off switch for entire system (50 and 60 Hz.). Note that the 729's are listed at 1.6 kVA each.

- R. Garner – Explore procuring a 60→50 Hz, 3-phase solid-state “inverter” rated at 5 kVA for the 1401/2/3/6 core of the system. Call a meeting with unit leads to go over power schematics (7/9).
- Bill Flora, Frank King, and Allen Palmer– Get motor power requirements in 1402, 1403, and 729 (for sizing converter startup load requirement).
- Bill Flora, Ron Williams – Determine whether VS 1402's ferro-resonant power supplies can be swapped with German 1402 ferro-resonant power supplies. Ditto for 1401 CPU.
- Allen Palmer – Determine whether the 729's can be operated with 60 Hz power. In particular, how is the tape speed over the tape heads determined?
- Mary and Sharon indicated that all the original German 1401 documents had been inventoried and were being removed from the server room. A master copy is being made of each document. The procedure for getting working copies is that the unit leads will ask Mary for as many as they need.

# IBM 1401 Restoration Project

Meeting #8, July 14, 2004

Summary by R. Garner

## Attendees:

Tim Coslet  
Don Cull  
Bill Flora  
Robert Garner  
Chuck Kantmann  
Frank King  
Stuart LaFarr  
Dan McInnis  
Fred Oehm  
Allen Palmer  
Ed Thelen  
Milt Thomas  
Dick Weaver  
Ron Williams

## Agenda:

- Introduction of new volunteers
- Team email & communications
- Facilities, Lab needs
- 50-Hz power status
- Unit bring-up status (Ron, Bill, Frank, Allen, Chuck)
- Documentation and Accessioning

## Meeting Minutes:

- Two new 1401 team members introduced: Stuart LaFarr & Milt Thomas.
- Reminder that all of us should register on the Museum's volunteer web site, <https://www.computerhistory.org/volunteer>, and log your volunteer hours.
- There was a request for more building access badges. It was noted that there is no phone in the server room and one can inadvertently get locked out.
  - Chuck – Ask Mike F. whether access badges could be issued to more than just the project leads; or work out a viable alternative.
  - Dag – Distribute a procedures & safety pledge form for all to sign. Re-present Museum's restoration safety and procedures again for those who missed 1<sup>st</sup> time.
  - Mike – Organize a CPR and First Aid class. Get a fire extinguisher and first-aid kit into the server room.

- Mike – Order replacement fluorescent lights and hole-less floor tiles.
- It was noted that there were no cotton or latex gloves, or breathing masks in the server room at the moment.
- Allison – A supply of face masks for the server room.
- There was a long discussion on the pros and cons of restoring the Deutsche 1401 (“DE 1401”) mechanical components vs. the mechanical components of the 1401/2/3 in visible storage (“VS 1401”). We confirmed, per the discussion at the 6/30 meeting, that in the case of electrical components and subsystems, we would stick with the self-consistent, 50-Hz DE 1401 and NOT mix and match electrical components between the VS and DE systems. However, due to the poor condition of the DE 1402 mechanical path, we agreed that it would be better to swap the mechanical card handling paths between the DE and VS 1402 card reader/punches. This approach would depend on permission from the Museum (and whether the two card handling paths are actually interchangeable).
- Bill Flora – Determine whether the VS 1402 mechanical path is exchangeable with the DE 1402 mechanical path.
- R. Garner – Explore options for cleaning/restoring of the 1402’s mechanical path.
- Regarding the 50-Hz power issue, we continued discussion on the proposal from last meeting of running half the system (1401/2/3/6) at 50-Hz and the other half – the 729 tape drives – at 60 Hz. This seemed feasible until we inspected the 729’s more closely to find that they all contain ferro-resonant AC power supplies. Furthermore, the 1401 and 1402 also contain ferro-resonant AC supplies. As we assume it would be very challenging to modify the resonance frequency from 50 Hz to 60 Hz (a decrease in capacitance by  $(50/60)^2 = 0.69$ ), we concluded that the best solution is a 50-Hz source for the entire machine, at 13 kVA. (Although we could use a smaller static converter for initial bring up, say about 5 kVA.)
- Although we do not have a 60→50Hz converter in hand yet, we acknowledged that plenty of work lies ahead to make forward progress: cleaning fans/filters, reforming the capacitors and testing the power supplies (disconnected from their loads), etc..
- R. Garner & Dave Bennet – Explore procuring at least one 60→50 Hz, 3-phase solid-state converter rated at 5 and/or 13 kVA.
- There was an involved discussion about documentation control. In summary, the Museum is keeping the original copies sequestered away, with no access (called “C0”); will make one master copy (called “C1”) which can be used by Mary or the Museum staff to create multiple additional, working copies. One such copy will be the machine-room “logics” (called “C2”), which will reside in the server room to be kept up-to-date and accurate.
- Mary – Distribute C2 logics and working documentation according to unit lead requests.
- Regarding documentation, there was a consensus that we need a full set of the so-called “Parts Catalogs”; i.e., the “manufacturing and assembly drawings” for the system.
- R. Garner – Search sources inside IBM for 1401 system Parts Catalogs.
- R. Garner & Dave Bennet – Contact IBM Quarter Century Clubs in Boulder & Tucson; contact IBM Fellow Ric Bradshaw in Tucson, and Jim Wiedenhammer (worked on 729 vacuum system); & contact Henry Harvel, parts distribution (in Mechanicsburg, NY)

- Ed Thelen – Meet with Eric Smith to get blog features added to project web site.
- Next meeting scheduled for Weds, Aug 18th, 11-1pm. (Meeting time selection criteria: Summer vacation schedules, morning – to avoid afternoon rush, and during lunch, as some still have full-time jobs.)
- As a regularly scheduled event, every Weds, beginning in the morning, the sub-unit teams, under the direction of Chuck Kantmann, have a “roll-up-the-sleeves” restoration working session.
- If you have materials/updates for the project web site:

<http://www.ed-thelen.org/1401Project/1401RestorationPage.html>

Please email them to Ed Thelen.

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please email them to Ed Thelen.

- Ed Thelen – Meet with Eric Smith to get blog features added to project web site.
- Allison Akbay gave her presentation on the best/proper handling of artifacts. She reiterated no food/drink in 1401 server room. One should change gloves often as necessary so dirt/oil isn't transferred around. Latex & nylon gloves OK for greasy work, but then should replace with cotton gloves afterwards. She suggested that we use the “archival vacuum cleaner” (wherever grease is not involved), as normal shop vac tends to spew everything back into air. She also suggested that masks be worn when handling moldy or dusty items. Cleaning solvents should be tested first before general use (and never on the outside surfaces of the units!)
- Allison – A supply of nose/mouth masks for the server room.
- Next meeting scheduled for Weds, July 14th, 11-1pm. (Meeting time selection criteria: Morning, to avoid rush hour in the afternoon, and over lunch, as some folks still have full-time jobs. Sub-unit teams have established their own, convenient work hours – which should be communicated to the entire team alias!)
- Unit-lead-only meeting called for Friday, July 9<sup>th</sup> to discuss 50-Hz power and bring-up plans.