

Large Format Digitization with new equipment and new workflows in the Swiss National Library

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Abstract

The Swiss National Library (SNL) operates a variety of different digitization projects for different kinds of materials. Besides newspapers, journals and monographies the SNL holds unique collections of writers' legacy and a great number of objects like posters, plans and drawings. Posters, plans and drawing are most of the time of a larger format than the other objects. The digitization service has a duty to digitize them all. This paper shows the quest to find and utilize equipment large enough to digitize objects that exceed the usual sizes of books and newspapers. This is a case study of the Swiss National Library, and its vendors and equipment are named. It shows the process of getting new equipment and installing new workflows in the SNL for a specific use case of this institution. The SNL does not provide an assessment of the market or any statement on other brands or vendors. This paper is not a reinforcement of any brand or vendor but solely states the choices the SNL has made for herself. It is not to be read as advertising or recommendation of any kind.

The Swiss National Library

The Swiss National library (SNL) is the countries governmental library with the duty to collect, preserve and convey Swiss cultural heritage called Helvetica.

Like every other library the SNL has a reading room for people to visit during the opening hours and with a library card people can borrow books. The SNL holds a huge number of items in its underground storage facilities.

The SNL holds different kinds of collections and is also comprised of many different departments which include a museum and the "Phonoteca" (collection and experts of and for A/V) in different cities of the country.

On the grounds in Bern, where the SNL has its main library building, the storage holds all kinds of materials of which paper based, or photographic material make up the largest number of items.

Due to the duty of making the collection available and because of new needs of emerging fields like Digital Humanities research the SNL has its own Digitization service.

Digitization in the Swiss National Library

The Digitization service in the SNL is a small team of people who are responsible for the digitization of everything apart from audio and A/V material which includes all the above-mentioned items from small to large. In a vast number of projects objects are being digitized either with external vendors or in-house. Unique items such as handwritten documents, posters, drawings, plans and alike are being done in house. The digitization service is a mass

production unit and does not do patron requests, for which the SNL has its own reproduction service.

In the past years all the digitization of the SNL has been changed to adhere to best practices and ISO Standard conform quality. For reflective material the SNL has chosen to use the ISO Standard 19264-1 [1] as the means to ensure the quality of the imaging system. Workflows have been created to ensure a standardized, controlled and documented quality of the digitization and creation of preservation masters.

All digitization (external and internal) has adopted these workflows and quality standards.

The change of to the use of the ISO-Standard 19264-1 for externalized digitization with vendors has been described in a former publication.

The internal digitization of objects that are unique like collections of prints and drawing as well as handwritten objects also has changed to adhere to this ISO-Standard.

As the SNL has been digitizing objects for many years before, equipment was bought long before the ISO-Standard emerged as well as it was time to replace the older equipment for newer machines.

To ensure the adherence to the ISO-Standard the SNL has chosen to use mainly UTT (Universal Test Targets) [2] as the primary device level target for the digitization projects.

The SNL sees the importance of being open to all possible kinds of workflows and targets and keeps stock of other sorts of device level targets as well as several different calibration targets. This gives the SNL also the flexibility to change the workflows according to the needs of the projects. It is important to note that the choices the SNL has made and that are laid out in this paper, are solely based on the SNLs needs and may differ for and from other institutions.

With the change of the equipment and quality level as well as accompanying workflows a wide range of objects could be digitized in-house of a high quality. However, another kind of objects remained in the storage facilities that proposed a different challenge.

The larger objects and their challenges

The machines in stock were machines that could fit objects up to the size of DIN A1. DIN is like the ISO Organization an organization that creates and publishes standards in Germany [3]. DIN formats for paper sizes are widely used in Europe and DIN A1 would translate to a paper size of 594 x 841 mm or 59.4 by 84.1 cm. Usual paper that would be used in a printer to print this publication in Europe would be a DIN A4 size or 210 x 297 mm.

While the in-house equipment was ready and set for mass production of objects either flat or bound up to a size of DIN A1 the

storage of the SNL contains many items that are significantly larger than DIN A1. Prints and drawings are often up to DIN A0 large (DIN A0 means 841 x 1189 mm) or even larger.

The quest to see how those objects could also be digitized properly with all necessary care for the objects as well as following ISO-Standard 19264-1 the question arose what the largest objects that are in the storage would be. We quickly got to know that the most common large objects are posters in a format called “World” or even bigger “City”. Those are not DIN – formats but very commonly used for posters and billboards. World-format translates to 89,5 x 128 cm and City-format is 119 x 170 cm. Both of which are too big to be handled by our normal machines.

Why buy a new machine?

Of course, there are ways to digitize larger formats without buying a completely new machine. As has been done in the past, one could digitize tiles and stitch them up in the software to create one large image. That requires enough space to handle the object safely around the digitization station and there is enough space in the room itself. That was not the case for the machine that could digitize up to DIN A1 sizes.

Another option would be to mount the camera from one stand to another stand in a place where there is enough room but that means transferring the camera equipment, recalibration, adjusting, etc. every time. That is not very efficient, and it blocks the camera for other production. Yet another idea would be to buy a second camera and set up a big table/space where the objects could be handled safely. While all of this is possible, the problem of the stitching remains. Stitching means it requires more tiles and therefore more images to be shot, lots of handling of the object, people that have a longer time to shoot the object, as well as handle the object, take extra care in the imaging and do the stitching and control the stitching. It means a lot of manpower. In a mass digitization the aim is to do as much as possible in a high quality but also very efficiently. Staff costs are the highest costs in a digitization process and thus it is wise to find ways to spend their time as usefully as possible. In our process it seemed more efficient to search for another solution to our challenge of producing the best images of large format objects.

We went on a quest to find a machine that would help us cover the most common large format objects in our storage in a highly efficient way on a quality standard that adheres to ISO-19264-1 Quality Level A.

The path forward

When presented with this wish, it is important for an institution to address the real need to buy such a large machine and to assess carefully if this is the best solution. Buying equipment takes time and effort especially in federal institutions and money must be accounted for and is not to be spent easily. This also means the first requirement is to find out how many items approximately would benefit from such a new machine and what would be the saved time and cost estimation in contrast to the other solutions available.

An analysis has been carried out to assess these topics and the conclusion was that there is a huge number of items in the storage of the SNL that would be eligible for digitization on larger

equipment and the calculations how much time and staff this would cost made it clear that the SNL digitization would be more efficient with a machine capable of a larger format than DIN A1.

The next step was to find out what the exact requirements of such a machine for the SNL would be and to see if there are any suppliers that could possibly provide such machines.

The SNL absolutely wanted the solution to adhere to ISO Standard 19264-1 Quality level A and should need no more than a few buttons to create a workflow that can be executed by basically everybody in the SNL.

This is an extra challenge for machines in high quality digitization as they are highly specialized equipment and come with a lot of software possibilities. Lots of options and buttons can be used and the firmware and software to capture and process images can be quite a study field of its own.

However, the SNL has another challenge here

The digitization service only consists of a few permanent staff and works with civilian service personnel a lot. Civilian service means: in Switzerland there is a compulsory military service which can be also done as a civilian service in several institutions and companies like hospitals, schools or the National Library. The digitization service offers three places to those service members. That means that they can apply for these positions and stay between 11 days up to six months depending on their duty schedule. They are between 18 and 30 years of age and come from each field of the society and each background – just out of high school or during their (unrelated) study or from different work backgrounds. They are therefore untrained staff and because of the nature of the duty as well as how the digitization service is set up, we need our workflows and machines to be suitable for staff that receive approximately two-to-four-hour training. Besides having a high turnover in staff this way, the digitization service needs to have a quick introduction ready for people to be able to help produce high quality images of their cultural heritage.

So, the machines must be bought with that in mind. It adds another requirement to the catalogue – The machine needs to fit in a workflow that can be executed by anybody regardless of background and training and it needs to be explained within a few hours to staff that comes from outside of the cultural heritage imaging field.

If this requirement is fulfilled the SNL digitization service could potentially benefit even more because it could also train other staff to help with the digitization of those large format objects if needed. On the other hand, that means that when creating a workflow, all this has also to be kept in mind.

The procurement

After a process of thinking through the main requirements for the machine that is needed as well as a rough idea of the workflow intended, the SNL set out to write a requirement document according to the regulations of the Swiss Government to enter an official procurement process.

For the large object digitization, we wanted the following requirements to be fulfilled:

- Must be able to do any size of object larger than DIN A1 size –we anticipate flat objects and not 3D objects like a museum would have.
- The larger number of objects covered are ranging up to 119 cm by 170 cm and need to be covered by one image.
- No stitching of the maximum size image – which is 119 by 170cm at least.
- The machine must be able to adhere to ISO 19264-1 Level A.
- The machine needs to be open on three sides to handle objects safely.
- Our preservation conservation department had to be satisfied with the safe handling of the objects: loading them to and off the machine.
- The lights had to be according to the preservation conservation standards for cultural heritage objects.
- For the digitization service in the SNL continuous light is preferred.
- The machine needs to be able to have different settings according to the specifications of the project regarding PPI.
- The machine must be able to give out specified file formats.
- The machine should be easy to maintain.
- New updates must be available during the contract time for hardware as well as software.
- The machine must have an expert mode as well as an easy mode.
- The power supply must be suitable for Swiss Energy net. Swiss power supply is different to US or EU power plugs which means the power plugs must be suitable for the Swiss wall sockets as well as the power lines in Switzerland.
- The hardware must be built for longevity and should last at least 15 years. To be able to have updates or upgrades or fix problems, the machine should be built modular to make exchanges possible.
- Etc.

After having a better idea what the requirements would look like, the SNL set out to see if such machines would be available on the market or if this was a completely unusual request. Fortunately, there are several vendors that build machines larger than DIN A1 and even DIN A0 size. We were confident that we could open our procurement procedure and fine-tuned the requirements we wanted and entered the process.

To give an idea of the timeframe of the procurement: The whole process from idea to having the contract signed took over three years. The SNL is not the only institution that has to go through a lengthy process, so the advice is to keep in mind: Procurement of all machines needs to be thought of carefully in a multi-year plan.

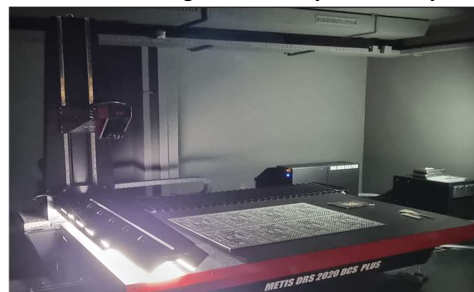


Fig. 1. Final Product acquired for large format digitization:

At the end of the procurement process, we ended up with a METIS DRS 2020 DCS plus machine which was installed in the SNL in March 2024.

The machine fulfilled our requirements and fitted in our space. That was another of our worries as our building is constraining us in heights and room to fit larger machines in. There is only one small part of the building where we can have dark walls – which is for digitization purposes the best choice to have. The rest of the building has white walls, and we are unable to change the color of the walls. We are also not allowed to mount anything on the wall, which limits our choices in what we can do or buy. Another of our considerations was that the space needed to be blocked from daylight. Therefore, the choice was very little and there was only one room available in the building which meant the dimensions of the equipment we would like to procure would need to fit in there as well. Another big problem in our building is the ceiling height which is too low for a lot of equipment we were looking at – not only in this case but in many cases before already. We often had to find custom-made solutions to fit any equipment in the building. Fortunately for us the METIS DRS 2020 DCS plus was exactly the right size.

This machine also includes a scan area of 1.2x2 m which is larger than the “City”-format we were searching for.

The machine comes with its own vacuum table and suitable safety measures for a machine this size. Safe handling of not only the objects but the machine was something that we had not required but METIS S.R.L. had thought through already. There are several emergency brakes, and the power supply can be stopped immediately. Another thing that we did not anticipate is the sheer amount of power supply we needed to provide for the machine and its vacuum table, but we were lucky that the building and the designated room were equipped with the right amount of power supply for the machine.

After the installation of this machine, it had to be calibrated and tested to adhere to the requirements and to the desired ISO-Standard 19264-1 quality level A.

In this the SNL was presented with another challenge.

The ISO-Standard 19264-1 challenge

The ISO-Standard 19264-1 does explain in detail how an imaging system can be measured and with what parameters it can be done.

The SNL – as said before – has chosen to use UTT Targets that can be used to verify the performance of the machines. Those targets do come in various DIN-formats and can be bought measured. Because the SNL digitization service has a mass production unit, all kinds of DIN-sizes from DINA4 to DINA0 have been readily available in house before. DINA0, however, is much smaller than the new machines scan area of 1.2x2m or 120x200cm.

Given the fact that the machine is capable of larger formats than the target size as well as having to digitize larger objects than DINA0 size, the question arose on how to test and validate the machine for production.

The challenge of creating a workflow that also works with new staff all the time added to the problem.

The SNL follows procedure to have all machines tested and validated before production sessions start.

To accomplish this, the targets are always the first image taken and the validation of the target is done in accompanying software against the specifications set in the project requirements adhering to the ISO-Standard.

As the next figure shows, DINA0 size is very small compared to the scan area and therefore workflows need to be created to test the complete area if larger objects are being done. The scan area is shown by the brighter frame.

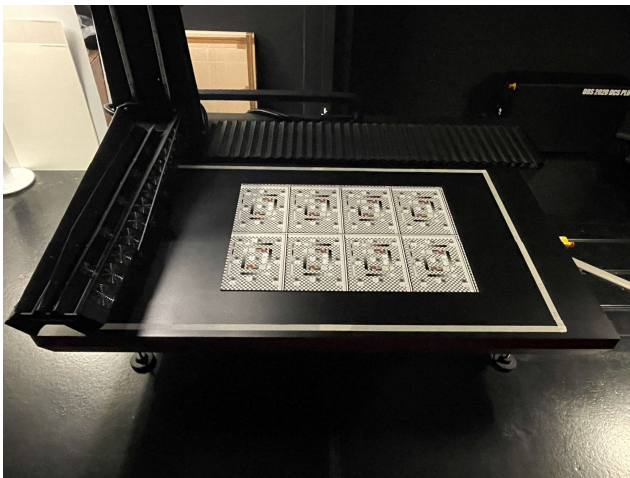


Fig. 2 Scan area of the machine plus UTT A0 size

The SNL could think of different workflows that would work with this:

It is possible to put the A0-target vertically and place it in three different places (left – middle – right) to capture the complete area. This would result in handling the target three times, it requires precise handling, consistent placing and making three different captures and of course analyzing the target three times. While this sounds time consuming, and it is – it also has a lot of potential for error. The staff need to ensure that the target always is put in the exact same place, in the same direction, and the images need to follow, for example naming conventions to be analyzed properly but also to be able to recreate what was done in which order.



Fig. 3 UTT Target A0 size vertically on a part of the scan area

Based on our experience even with the best written workflow documentation and lots of training, this can easily be a challenge in the real daily production process. The change of staff that carries out production forces us to make it simpler and more reliable and less prone to error. And finally, we thought that it would not be very fast and efficient to do so.

With Image Engineering from Germany, which is the company that manufactures the UTT targets, we discussed our challenges in this and laid out our worries about the workflow with more than one capture. Our wish was to have a target that could cover the complete scan area of the machine. One target - one image – one analysis.

The UTT has a design that makes several repetitions of the patterns as it covers multiple sizes. Using DIN-formats they fit perfectly. 1x1.2m area is however not a DIN format. We had several discussions with Image Engineering's engineers about the possibilities but in the end, including the discussion about whether it is necessary to cover the complete area of the machine, we decided to have them make us a custom-made target for our new machine.

Now the engineers from Image Engineering had to design something that would cover a different area and adhere to ISO-Standard 19264-1 and could be measured and analyzed by the software. Of course, the SNL would need to be able to handle the target and software easily as this was one of our main challenges with other workflow options.

The engineers had to draw up designs on how to make this possible and find a way that the resulting target wasn't too heavy as we need to lift it on and off the machine regularly.

We did agree that it would need more than one person to handle the target itself because of the sheer size.

Discussions have been around the arrangement of the tiles and which direction the tiles on the target would need to face and the engineers were very supportive of the needs and wishes of the SNL. In the end a design was presented that can cover the complete 120 by 200 cm of the machine.

We can therefore analyze the complete surface the scanner can see.

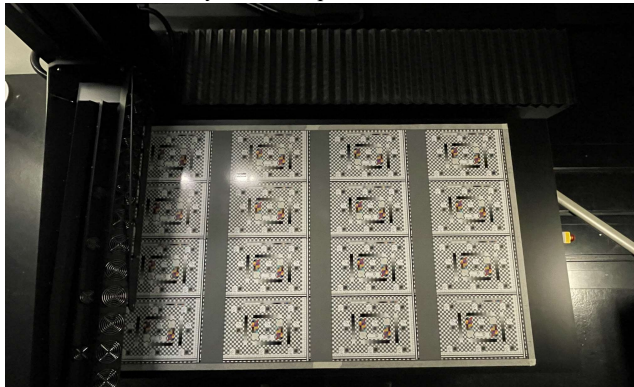


Fig. 4 the custom-made target covering the scan area completely on the machine, faced from above

The target is designed in stripes that include sixteen tiles to be analyzed each of DINA3 size that cover the complete 1.2m in height that the scanner can capture, with a total of 144 slanted edge targets and 64 gray scales covering the complete area of the scanner. The scanner moves from left to right in the shown figure 4.

To accomplish a complete image of the target, the placement of the target on the scan area has a tolerance of approximately 0.5mm. Precision is important for the analysis of the captured image.

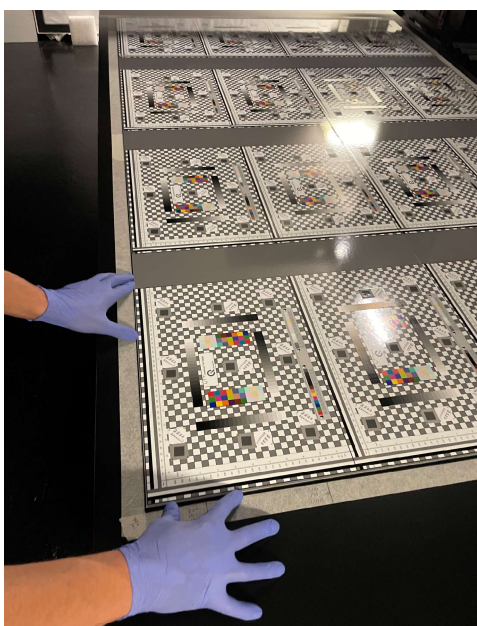


Fig. 5 Placing the custom target on the machine

The target is not too heavy but needs to be handled by two people loading on and off the machine because of the size. It is completely measured and because of its custom design the analysis software also was a topic we needed to address with the engineers from Image Engineering. Their software can measure the standard sizes of the UTT but the detection of Regions of Interest (ROI) on this design was nothing the software could do. Therefore, we also had to customize the software to be able to validate this target. Again,

Image Engineering customized our software to make this validation possible in our production process.

This was also necessary for the installation of the scanner itself when METIS S.R.L. installed and calibrated the scanner on premise. They needed to make sure that the scanner was calibrated to perform on ISO-Standard 19264-1 Level A over the complete area the scanner can see.

With working together with all companies in this quest, the SNL now has a scanner that can do large format digitization on the highest quality.

The workflow

The daily production workflow must be set up to be easy, steady and give the same results and quality no matter who is performing the work. That means that our temporary staff needs to be able to handle the workflow themselves and the result must match our permanent staff's performance.

To address this, we have already taken several steps, like the custom-made UTT target, a frame on the scanner (shown in fig. 4 also) to show appropriate placement for several situations and resolutions, lots of training documentation and hands-on training agreements with our preservation conservation department for safely handling the objects.

But all can be thrown off when the software of the equipment is too difficult to handle. One of our requirements for the procurement was that the machine has an easy mode and an expert mode.

The thought behind that was to make it easy to use the scanner with temporary staff and make a suitable workflow.

The scanner manufacturer did make this possible according to our wishes and we were able to create basically a three-button workflow where staff can use three buttons and only check the presets to get ready for production. The main extra work is to select the file name given to the images and the location of the files on the computer.

That means for the SNL that training time can be reduced to operate the machine, and more focus can be laid on the safe handling of the objects themselves.

The workflow now consists of several easy steps including turning on the machine and software (first button), checking the presets for the production session according to the project requirements regarding PPI for example, checking the file saving location and setting the correct file name. After placement of the target the pre-scan button (second button) is used to check if the placement of the original is according to the requirements with respect to skew and location on the scan area. If the object lays correctly the third button (Scan) is used and the final image is created.

Being a scanner the machine moves over the object to create the image, and the files are stored in a format that was agreed upon installing. At this point the SNL creates rather large images in 48bit color, ranging from 800MB to 3.58 GB per file depending on the size of the object.

The more challenging workflow part remains with the safe handling of the objects themselves. Most of our objects exceed the size where they can be handled safely by one person. In our current project there are always two people present to handle the originals while loading on and off the machine.

Lessons learned

The SNL has taken on a quest to buy a new machine for large format objects and has been successful in this.

Nevertheless, we have learned a few things:

- First, it is crucial to analyze the need for such equipment. As this process takes a lot of time and effort not only for the institution but vendors as well, it should not be considered lightly to go into the procurement. What is really needed for the task and what is a nice-to-have? Where can compromises be found and where not?
The SNL has thought about this long before the actual process started and tried to find out as much as possible about the options available before entering an official process of procurement. This helped us very much in the process as we were able to give clear answers to various questions in the process.
- Knowledge of needs and wishes not only about the machine and the image quality but also in terms of workflow was essential for the customization of targets and software.
- Communication should be clear and transparent with all stakeholders. Not only with vendors, procurement officers or others but also internally with, for example, the management to make the necessity of the equipment clear or the preservation conservation department to ensure the safety of the objects.
Having good communication with the vendors to have open discussions about the needs and possibilities was important in making the final success possible.
- Patience is also a very important key to the process. While the digitization service felt the rather urgent need to digitize large objects – which triggered of course the whole process in the beginning – this needs time and a good portion of thinking the process through. This also meant that we did not start production with a work-around before the complete process was finished.
- Sometimes customization is necessary for the most efficient workflow that fits the needs of the institution.
- Taking time to have proper installation and calibration as well as training and testing before the machine will go into daily mass production has helped carve out a robust workflow. The current machine the SNL has acquired is capable of many more things than the SNL needs and it was necessary to take the time to understand the machine and its software before choices for the best possible workflow in the SNL could be made.

- Having good workflow documentation is key in almost every situation but having an easy workflow was key in the special case with our temporary staff. There is no time to read manuals and if something is not clear, there is also no time to search for solutions in books and binders. Therefore, the documentation is also short but clear – like the workflow itself.
- Making the insights into this process and capabilities of the digitization service available and known to the institution itself: We had several tours to show colleagues in the institution what we are now able to do and how we are doing it. This has been a huge success internally.

Conclusion

The SNL was able to get new equipment that fits the needs of the institution and is safe for the objects intended to be digitized. A workflow has been created that is easy and can be carried out by temporary staff that can come from completely unrelated areas and backgrounds with little training. The requirements for the procurement were all met, and the machine is steadily producing high quality images daily. The process involved lots of new challenges to the institution, but they were all addressed. The workflow has proven robust, and few errors have been made in the past year of production. The digitization service of the SNL has expanded its capabilities to digitize large format objects, and the production capacity has increased.

References

- [1] <https://www.iso.org/standard/79172.html>
- [2] <https://www.image-engineering.de/products/charts/all/579-te262>
- [3] <https://www.din.de/en>

Author Biography

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