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THE ROLE OF PACKAGING TECHNOLOGY IN LIBRARY PRESERVATION: BEST STORAGE PRACTICES AT THE NATIONAL LIBRARY OF HUNGARY

Բանալի բառեր՝ գրադարան, փաստաթուղթ, երկարատև պահպանություն, անխարգելիչ պահպանություն, փաթեթավորման տեխնոլոգիա, անհատականացված տուփեր, ArtiosCAD, ստեղծագործականություն, i-cut Production Console, կայունություն:

Keywords: library, paper-based documents, long-term preservation, preventive conservation, packaging technology, customised boxes, ArtiosCAD, creativity, i-cut Production Console, sustainability

Since the foundation of the National Széchényi Library (NSZL), it has served as a repository of knowledge and a custodian of Hungarian cultural heritage, making paper-based and electronic library documents publicly accessible.[17] Therefore, it is our duty to preserve[18] our collection in the best way possible for future generations. We have adopted a new sustainable practice to protect cultural heritage objects housed in the national library. In this paper I will discuss our approach to preserving our analogue documents.

First, I will briefly introduce the institution and provide an overview of the library's collection of analogue documents, objects of various shapes, materials and storage needs. Then, I will describe what constitutes a suitable storage solution for valuable documents. Next, I will present how to create specialised housing solutions for our rare and vulnerable objects using mechanised methods. I will provide insights into how we use our packaging technology preparation and implementation station. I will show a few examples of our creatively designed boxes. Finally, I will outline the possibilities and solutions offered by the system. As a summary I will discuss the impact of this innovative solution on further improving the preservation of objects in our collection.

The institution and its analogue collection

The NSZL, Hungary's first public national collection and public institution, was founded by Count Ferenc Széchényi in 1802. Since 2024, it is a member institution of the Hungarian National Museum Public Collection Centre (HNMPCC). The NSZL collects[19], processes and stores the treasures of Hungarian national culture, be they in written, printed, audio-visual or electronic form.[20]

[17] In: *Mission and strategy*. https://oszk.hu/en/mission_and_strategy (06. 04. 2025.)
[18] Act CXL of 1997 (on Museums, Public Libraries and Public Culture) states that the preservation of cultural property is everyone's duty. [Bakayné Perjés, 2005, 5]
[19] NSZL has the task of collecting all works published within the borders of Hungary, in whatever language they may be written, all works published in Hungarian, all works written by Hungarian authors, or with the collaboration of Hungarians, not in Hungarian and outside Hungary, all works published abroad in foreign languages with Hungarian aspects. In: *History of the Library.* https://oszk.hu/en/history_of_the_library (06. 04. 2025)
[20] In: *Mission and strategy.* https://oszk.hu/en/mission_and_strategy (06. 04. 2025)

Since 1802, there has been a legal deposit system in the institution that ensures the most comprehensive collection of documents published in Hungary[21].

After the library was founded, an increasing number of documents were donated to the institution. The initial collection of the founder included some 13,000 printed books, over 1,200 manuscripts, hundreds of maps, coats of arms, engravings and coins. Back then, the library already had 33 medieval codices. During the 20th and the 21st centuries, the collection continued to grow with the addition of numerous bequests, manuscript volumes, letters, photographs, small prints, and even newer codices and language relics. Today's organised holdings amount to more than 10 million storage units.[22]

The library's collection encompasses a wide variety of objects. The composition of the collection can be examined in several ways. While this list is not exhaustive, we can highlight the following categories. The items that build the bulk of the collection are book-like monographic publications, newspapers and periodicals. The collection also includes medieval manuscripts (around 700 codices and 1000 codex fragments)[23], incunabula, modern volume manuscripts and printed books, albums and scrolls. Additionally, the collection contains private letters, small non-book manuscripts (poetry manuscripts, autograph photographs, handwritten invitations, dance cards, business records), and personal fonds. Maps (including the oldest printed map of our country, dating from 1528), raised-relief maps, globes. Leaflets, posters, postcards, music sheets. Photographs, microfilms, glass plate negatives, music records, phonograph cylinders, and other audio-visual and electronic materials. The collection comprises single items, series, multiple volume works, and related objects. Items greatly vary in size, ranging from micro books to double elephant folio size wall tapestries, wall maps, and posters.

The materials of the objects in the collection are also varied. In chemical terms, they are primarily organic materials, which can be either natural or synthetic. In terms of their function, they are substrates that carry written information, surface coatings, coverings, adhesives and decorative materials [Kastaly, 1986, 24]. The objects may be made from or contain materials such as paper, wood, leather, parchment, papyrus, textiles (cotton, velvet, silk), bone, glass, different metals, silicate, wax, glass plate negatives, photographic substrates, and other modern materials including records, filmstrip substances, audio and video tape, magnetic tape, magnetic discs, and more. The documents could be handwritten (pencil, inks, pigments, chalk), printed with ink, or decorated with pigments and gilding.

Preservation of library artefacts, focused on paper-based documents

The library's main objectives are to collect, preserve and provide documents. We need to ensure the long-term preservation of the collections, and their safe storage is of crucial importance. We must handle the objects with care, both in daily use, at digitisation, when they are transported or exhibited. In some cases, the artefacts will require interventive conservation-restoration treatments, but interventions should be minimised or avoided if possible, and preventive conservation measures should be prioritised. Interventive conservation treatments can be time-consuming, and require specialised materials and equipment, and therefore may be expensive. Most importantly, the principle of minimum intervention is now the guiding approach in conservation when it comes to preserving

[21] In: *History of the Library*. https://oszk.hu/en/history_of_the_library (06. 04. 2025)
[22] In: *Történet.* https://oszk.hu/tortenet (06. 04. 2025)
[23] In: *Manuscripts*. https://oszk.hu/en/manuscripts (06. 04. 2025)

the object. Within preventive conservation, the way in which the objects are stored is becoming an increasingly important topic.

The storage needs of different objects may vary. This might be due to their shape, material, condition, value, age, or use. We must store objects in suitably furnished stores, where the climatic conditions such as temperature, humidity, and light are satisfactory[24]. The immediate environment of the object, the storage unit, is also a crucial preventive conservation measure, that contributes to the long-term preservation of the object. It is essential to give the artefacts suitable protection by proper housing methods. By keeping objects individually packed, we can prevent deformations, indentations, and scratches caused by the storage and movement of the artefacts. We raise the question: What is the appropriate storage unit for valuable paper-based documents, of which we have a large quantity in our library? What criteria must such housing meet from a conservator's perspective?

The most effective way to protect the archival material is to place the documents in an acid-free box[25] made of durable material [Czikkely–Káli–Orosz–P. Holl–Szlabey, 2017, 90]. In general, paper is a suitable material for packaging, but it should also be of the right quality for long-term purposes, so it is important to choose acid-free, buffered[26] quality [Ibid, 44].[27] This buffered paper contains calcium or magnesium carbonate, which neutralises the acidic effects of the environment and degradation, so documents are stable for longer [Ibid, 123]. These special papers are used to make palliums, pouches, and boxes. A good storage unit in which the object is well secured, provides adequate protection with its durable material, and helps to protect the object's physical integrity, when stored or moved. When suitably prepared, a good storage unit protects the object from dust, other solid contaminants and, to some extent, harmful airborne pollutants in the form of gases [Kastaly, 1986, 53]. The well-chosen material can compensate to some extent for fluctuations in relative humidity, and it can protect the object from harmful light radiation [Ibid, 53].

Beside the basic expectations, the storage unit should ideally meet further requirements. To help the work of collection care staff, the object should be easily removable from the storage unit, preventing its damage during packing and unpacking. The unit must be just the right size to fit on the shelf, and it is an advantage if the box material is lightweight. It is also important that a good box interior cannot cause physical damage to the object. Therefore, only smooth material surfaces should be in contact with the artefact, and the lid of the box should not push against the object. It is a bonus if boxes can be prepared quickly, so that the object can be protected as soon as possible. Ideally a satisfactory box is prepared in consultation with the conservators, based on any special requirements.

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[24] We have a large number of paper-based documents in the collection, some of them are books covered with leather, which may contain wooden plates and metal fittings attached. In the case of paper-based artefacts, it is very important that relative humidity and daily temperature fluctuations are kept to a minimum (± 2 °C). The ideal temperature for paper is 16-18 °C, and the appropriate relative humidity is 50-60% [Bakayné Perjés, 2005, 21].
The ideal conditions for storing artefacts of organic origin (wood, leather, textiles) are: temperature 16-18°C, relative humidity 55-60%, maximum 50 lux light intensity, while light should be filtered for UV radiation. (Ibid, 16).
For storage conditions for other types of objects, see: Judit Bakayné Perjés, *Raktározás, tárolóeszközök és csomagolóanyagok.,* Budapest, 2005.

[25] The material of such a box shall comply at least with ISO 9706 standard or the more recent ISO 16245 standard. [Czikkely–Káli–Orosz–P. Holl–Szlabey, 2017, 90]

[26] Durable (buffered) paper, produced since the 1980s for documents and prints that need to be preserved permanently. [Czikkely–Káli–Orosz–P. Holl–Szlabey, 2017, 90]

[27] Exceptions for example are photographic materials, where the buffering alkaline additive may cause damage, especially in the case of images made with certain historical photographic techniques or photographic prints such as cyanotype. A specific requirement for photographs and films containing a silver halide (silver salt) light sensitive layer is the sulphur-free nature of the container material, the paper used for this purpose being called 'Silversafe' (ISO 18916:2007). [Czikkely–Káli–Orosz–P. Holl–Szlabey, 2017, 44]

A new, proven box-making solution

The question arises, how to provide suitable protective storage units for our collections. Today, we have an innovative mechanised box-making solution in the institution. Earlier, boxes were prepared by conservators or bookbinders, in situ. The items were made by hand, resulting in suitable protection for the objects, but the process was occasionally time-consuming. Purpose-built boxes could be visually appealing, more fitting to the artefacts' needs, and the box is longer lasting. The alternative solution was to order boxes from a company, but this was either too expensive, or their models gave us limited options, and the timing and planning factor made the process more difficult[28].

With the above in mind, the NSZL has found a sustainable solution to address this problem. In the institution most of the artefact containers are made using mechanised methods[29]. Since 2020 boxes can be produced by machine (Fig. 1.), many based on our own design, and made on site at our institution.

Fig. 1. Box-making machine

We use acid-free, buffered materials, and prepare our boxes after careful and thorough planning. We have a large stock of materials ready for use, and the flexibility and speed of work is not comparable to the old-fashioned ways of box-making. A major advantage is that we are able to reproduce custom-made unique designs as many times as we need it. Occasionally, rare decorative boxes are still made by hand by a bookbinder specialised in box-making as well, but now we have the option to speed up this process with the help of our mechanised packaging system.

We receive storage unit requests from three areas. The conservator colleagues request boxes for the objects they treated. Colleagues also request boxes for digitised documents. Sometimes,

[28] We used to order corrugated boxes in bulk, in 4-6 sizes, but they were not completely acid-free, and there was a minimum order quantity. If we ordered individual boxes, or multiple boxes based on our requirements it was far too expensive, because we had to buy the template and die-cutting knife before production.

[29] For the mass packing of less sensitive documents, like periodicals, we still obtain ordered expansion folders from a local supplier.

specific designs in uniform or varying size are ordered for discrete parts of the collection as a preventive conservation measure. The actual choice or the design is always preceded by consultation with the conservator, who orders the containers online. The workflow is transparent and traceable, set deadlines greatly assists the planning and production scheduling. If necessary, we schedule a personal consultation. In this design phase we talk about the details in depth; we find out if special measurements are required, whether existing designs can be modified, or a completely new idea is to be developed. At this time, we make plans how we would work together, as occasionally a colleague would adhere components of the box, or place the lining inside.

We use Klug corrugated board[30] in two sizes, in natural white-light grey colour. It is acid free, lignin-free, 100% bleached cellulose, buffered with calcium carbonate, pH 7.5-10. It has a smooth surface, high static strength, but it is lightweight. Also, frequently used material is the AlphaCell archival cardboard[31] in antique colour. It has a pH 8-8.5, it is also lignin and acid free, it is an alkaline mountboard with 3 - 5% alkali (CaCO3). Occasionally we use the Fedrigoni Papers (Fabriano) Fabria brizzato[32] in ivory colour. These are made of acid-free contents, they are 100% chlorine-free cellulose. Sometimes we use Prespan pressboard[33] in brown colour, which is made of paper pulp. It has neutral pH, very smooth surface, and dimensional and shape-retaining qualities.

About the mechanised packaging system

The packaging preparation system used at the NSZL – from the Esko[34] and Kongsberg[35] companies – has an integrated software and hardware solution. We use Esko ArtiosCAD[36] structural design software for preparing the storage unit templates. Afterwards we make the foldable box form on the Kongsberg Cutting Table, applying the settings by its production control software, the i-cut Production Console (iPC)[37].

As part of the ArtiosCAD structural design software, there is a Standard catalogue that contains ready-made templates (Fig. 2.) that can be easily resized, with several options for the design elements. This vector graphic program can be used to create single-use designs or to edit existing

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[30] The thickness of the material that we use is 1.6 and 3 mm, the weight is 560 to 570gr/m2, and the size is 998x1720 mm. It resists the ageing process. Compliant with ISO 9706. The three layers of the board are adhered with starch-based adhesive, which has pH 7– 8. The corrugated board is manufactured by Klug Conservation. https://www.klug-conservation.com/Corrugated-Boards (06. 04. 2025).
Distributed by Ceiba. https://www.ceiba.hu/klug_termekek/hullamkartonok (06. 04. 2025).

[31] The thickness of the material that we use is 0,5 mm - 350gr/m2, it has the size 810x1206 mm. The distributor of the cardboard is Ceiba. https://www.ceiba.hu/alkalicka_lepenka_alphacell (06. 05. 2025.)

[32] It complies with the ISO 9706 "LONG LIFE" standard for ageing resistant papers. The surface of it is embossed on both sides, with fine ribs and finishes. The weight is 0,3 mm - 200 gr/m2, and the size is 720x1010 mm. The material is an earlier acquisition of the NSZL, which was still a product of the Fabriano paper mill. Since 2002 the company has been part of the Fedrigoni Group and the *Fabria brizzato* type is no longer produced. The available paper is code number 00372204. The material can be obtained today from a Polish distributor at the following link: https://www.gammapapier.pl/oferta-2/item/papiery-wyprzedaz/fabriano-fabria (06. 04. 2025)

[33] The parameters are: 0,2 mm - 655x995 mm and 0,5 mm - 746 × 995 mm. Due to its neutral chemistry, documents stored in prespan files are guaranteed to remain intact for up to 50 years.
Distributed by Hungarosack. (06. 04. 2025.) https://hungarosack.hu/prespan-lemez (06. 04. 2025.)

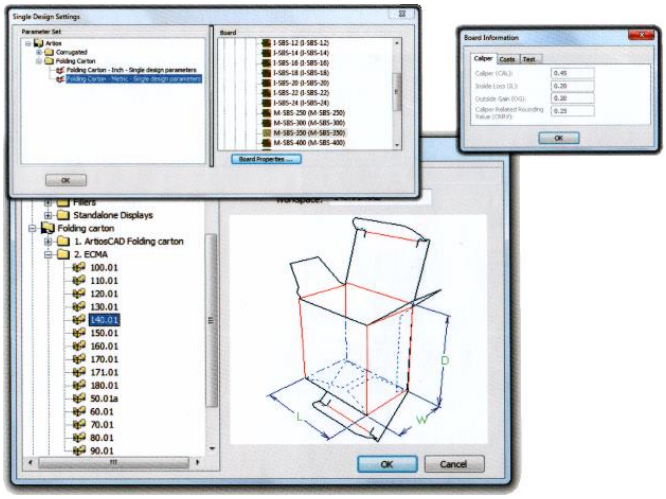
[34] Esko, based in Ghent (Belgium), is a well-known packaging preparation systems provider. https://www.esko.com/en/company/about-esko (06. 04. 2025)

[35] Kongsberg (Norway) manufactures cutting tables for digital post-production, and provides equipment for the packaging, advertising, display and manufacturing segments. https://www.kongsbergsystems.com/en/about/company (06. 04. 2025.)

[36] ArtiosCAD – [Electronic Resource] URL: https://www.esko.com/en/products/artioscad (06. 04. 2025.)

[37] i-cut Production Console 2.2. User Manual. Esko-Graphics Kongsberg AS. Document no: D3389. Part no: 32462293. (Document provided for Esko ID holders)

ones. With the Style Maker program in the software, we can build a design with presets and variables that make it easy to resize. We can set the program to interpret different material thicknesses and modify the design accordingly, which is helped by the program's integrated material database. The most interesting feature of the software is the 3D modelling display function that greatly helps and speeds up the design process. The combination of structural concept and modelling can save time and material by eliminating the need to produce a design while it is still in the design phase (Fig.3.), until it is declared the final version.



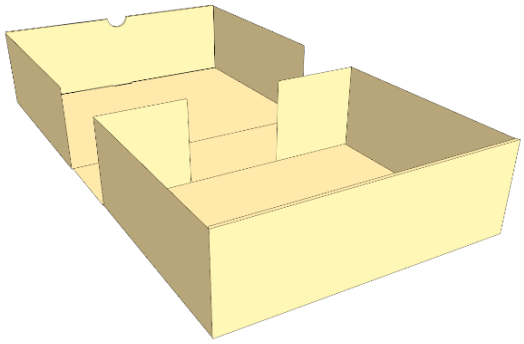


Fig. 2. Resizable template from Standard Catalogue of the ArtiosCAD designer software
Fig. 3. 3D display from ArtiosCAD of the Clamshell box we generally use in the library

The cutting system's basic work unit is the cutting table[38]. We use a Power Head unit with it, which moves[39] on rail above the table and can be fitted with various tools. The head unit can be easily positioned back and forth and left and right, and can be fitted with cutting, creasing and drawing/writing tools. It can be used to crease and cut material from both sides with perfect fit, aided by the adjustability to the laser pointer and the table vacuum. A vacuum pump is connected to the cutting table, which holds the material tightly on the table by applying vacuum through the small slots on the cutting table, and on the covering cutting underlay. The Power Head base tool unit can be equipped with a Vibrating motorized knife tool, which is suitable for cutting corrugated cardboard. A compressor is used to power this tool, as it is working with compressed air control. For this purpose, we use stronger blades, which gives a gently corrugated cut. If we cut archival cardboard and thinner materials, we attach the Static knife to the head with different blades. The Creasing wheels, which we use in several sizes, are also associated with the material being cut. Occasionally we use the Pen tool – in several colours – to display drawings, logos, and lettering on the material.[40]

The production control software of the cutting machine, the i-cut production console has very precise tool settings. The program allows for manual adjustment of tools and machine settings, with an accuracy of up to one hundredth of a millimetre. There are pre-settings, and a configured set of materials and tools. In addition, a series of presets can be entered in the program, which then selects

[38] The maximum working area is 1680 x 2190 mm, the maximum material size to be placed on is 1740 x 2570 mm.
[39] The maximum speed is 83cm/second.
[40] Tooling guide for Kongsberg X cutting tables. Kongsberg Precision Cutting Systems. [Electronic Resource] URL: https://kta.fi/doc/Kongsberg/G2558711_Tooling_Catalogue_for_Kongsberg_X_us.pdf (06. 04. 2025.)

the right tools for the design. The Layout function (Fig. 4.) allows us to pre-design how the templates will be positioned on the material of a given size. We can set the machine to just draw on one side of the material and then, after flipping the material over and placing it at the other matching point, to crease and cut from the reverse side at the exact position. The control panel – in the informative user interface – provides real-time information on the status of the work and the time remaining. The distance between the table surface and the tools can be mapped, and the information can be stored so that, in the event of surface unevenness, the machine itself adjusts the height of the tool to the table surface, enabling smooth cutting, creasing or drawing. Both the acceleration and speed of the tools can be adjusted precisely.

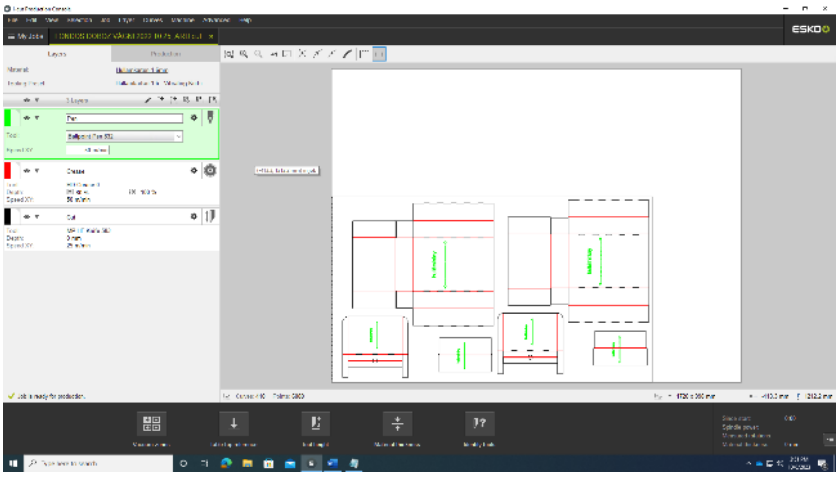


Fig. 4. The i-cut production console cutting control software displays the layout function and the chosen tool setting

Creativity realised – storage units for general use, and customised boxes

It is always the need of the object that determines the suitable box. The material of the object will indicate whether it should or can be placed in a buffered material, and for composite objects the storage needs of the more sensitive material will serve as a guide. We should also consider what can fit in the storage area. More stable and/or less sensitive documents are usually placed in cardboard folders, and those that need more protection are placed in containers made of thinner or thicker corrugated board, depending on their weight and size.

We might decide to use a box template from the Standard catalogue of the designer program. There are several shapes to choose from, alteration is possible, and we can apply a variety of features of the program for template edit. There are certain box shapes which are suitable for specific object types. For example, our parchment-covered books need a tighter enclosure, therefore we prefer to use a box that closes tightly, and choose a given prototype from the catalogue. However, the pre-designed boxes are not necessarily suitable for all our objects, and we prefer to take advantage of the possibilities offered by the design software. Our boxes are made with a folded design, and we rarely use adhesives in their preparation. Occasionally, when the protective box of an object requires a strong hold, we carefully apply a small amount of PVAc (polyvinyl acetate) adhesive onto the buffered corrugated board.

For general use, proven designs such as the Clamshell box (Fig. 5.) and the Four flap folder (Fig. 6.) are produced. These types are created based on already existing box shapes. The clamshell

box and the four-flap folder are easy to open, they have a convenient shape. Both close in a way that prevents the material of the container from being pushed against the artefact protected by the container. The clamshell boxes can be lined with a soft fabric by a conservator, if the object is fragmentary with loose parts or if its material is sensitive by its nature. Sometimes we use machine cut paper padding in a wedge shape at the base of the box, to compensate for the deformations of the book. The resizable designs are made by scaling the template to the actual material. This allows the same shape to be made from materials that have different thicknesses (Fig. 5.). Because it can be resized, there is little time investment in making the above introduced standard folder or box.

Fig. 5. Clamshell boxes made from corrugated board and from archival cardboard[41]
Fig 6. Four flap folders made from archival cardboard[42]

Customised boxes

Although the above-mentioned solution is suitable for most of the documents in our institution, due to the diversity of the items in the collection, there are objects with specific storage needs. It can be a challenge to provide compartmental storage boxes for objects which need to be stored together, or to create an appropriately fitting storage unit for irregularly shaped artefacts. Unusually large, small, fragile or heavy items can also be difficult to deal with. For these objects with special needs, we either convert Standard catalogue templates, or design new inner compartments, or in some cases we draw up entirely new models with Style maker. We also make boxes with the combination of the methods described above.

Often it is necessary to create an additional underlay at the base of the classic clamshell box, to secure or support the object in a more effective way, as shown in the example below. For a codex or incunabula-type book which have protruding metalwork attached to the covers, we use an additional layer of corrugated board with cut-outs to hold the book firmly on the underlay. The photograph below (Fig 7.) shows that we created a space for a small folder where we can safely store with the object those fragments of the book that have been removed during conservation treatment and cannot be reset.

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[41] The artefact in the big box is: *Klasszikus arany biblia, 2. kötet. Hock János: Az üdvnek új-szövetségi történelme.* Lipcse-Budapest-Bécs, Herzig, 1897. It is located in: NSZL General Collection. Shelfmark: 503.742/2. The artefact in the small box is: *Schöne andächtige Gebetlein inn diesen gefährlichen Zeiten sonderlich zu gebrauchen, Leutschau*, Samuel Brewer, 1676. It is located in: NSZL Early and Rare Printed Books Department. Shelfmark: RMK II. 1377a/1. péld.
[42] The artefact is: *Himnusz másolatának bőrkötéses díszmappája*. It is located in: NSZL. This decorative leather folder of the copy of the Hungarian National Anthem was recently created by library bookbinder Edit Balaványné Albert. The gilding on the object was recently done by library bookbinder István Molnár.

Fig. 7. Box with added cut-out underlay, that holds a folder for additional fragments[43]
Fig. 8. The underlay compensates for the unevenness of the book

A similar example is a display and protective box for a certificate of honorary citizenship (Fig. 9.). It is decorated with protruding enamel and copper embellishments and gilding on the leather, with a wax seal case made of copper, attached to the certificate with a delicate metallic cord. This volume rests securely on the underlay of the custom-made box, and the copper case of the wax seal has a separate enclosure inside the side panel. This ensures that neither the case, nor its metal cord come into contact with the cut edges of the corrugated board.

Fig. 9. Display and protective box with a cut-out underlay[44]
Fig. 10. Box with space filler for a small size book with its larger size insert[45]

[43] The artefact is *Der neundte Teil der Bücher des Ehrnwirdigen Herrn D. Martini Lutheri, darinnen die Propositiones vom Ablas wieder Johan Zetzel begriffen... Wittemberg: grdruct bey Simon Gronrnberg,* 1590. It is located in: NSZL Early and Rare Printed Books Department. Shelfmark: Ant 1057. The recent restoration of the artefact was carried out by paper and leather conservator Emőke Baranyai.
[44] The artefact is *Csiky Gergely aradi díszpolgári oklevele, 1881 március 10*. It is located in: NSZL Theatre and Music Department. Selfmark: SZT Analekta 984.
[45] The artefact is: *Grünwald Béla: A Felvidék. Politikai tanulmány*, Budapest, Ráth M. 1878. Attachment: *Grünwald Béla levele Kossuth Lajoshoz*. It is located in: NSZL General Collection. Shelfmark: Kossuth L. 904=90.

Once, we received a request to make a storage box with a space filler for a small size book, which has an accompanying larger size letter insert. (Fig. 10.) The space filler is an underlay, built from folded elements. The template is resizable and has been used for creating storage units for other objects in the collection.

A compartmental box was created to store and display wooden puzzle in its upper drawer, and a smaller booklet placed it the drawer below (Fig. 11.). The advantage of this solution is that the wooden puzzle can be viewed with the box lid opened, the lower drawer can be pulled out to display both items at the same time. Moreover, this solution reduces unnecessary handling as the objects can be moved without taking them out from their compartments.

Fig. 11. Compartmental box for display and move of an artefact and its related object without handling
Fig. 12. The parts of the compartmental box separated

One of the most interesting tasks was creating a storage unit for related volumes in such a way that all items are placed in one container (Fig. 17), but remain separated from each other (Fig. 13.). They have vulnerable, powdery leather cover, therefore direct contact between the volumes would cause further physical damage. The solution was a folded divider unit placed inside the box (Fig. 14.). The design can be resized for the specific measurements of a series of books, taking into consideration individual volume thickness. The divider panel can also be altered to separate pairs of books, or multiple volumes (Fig. 15-16.).

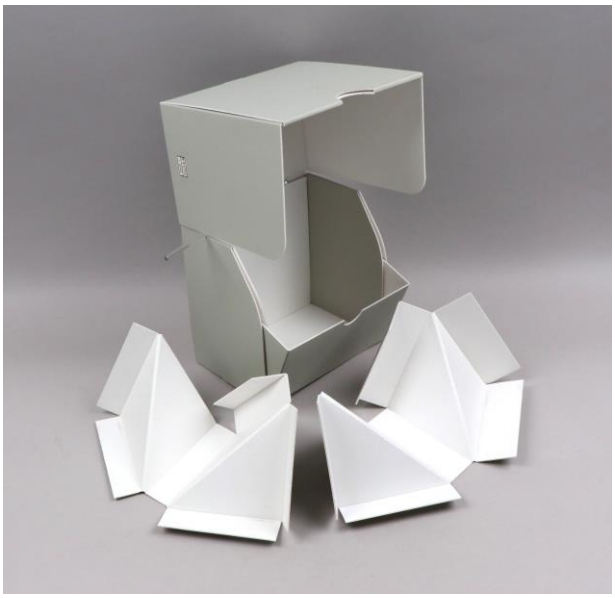
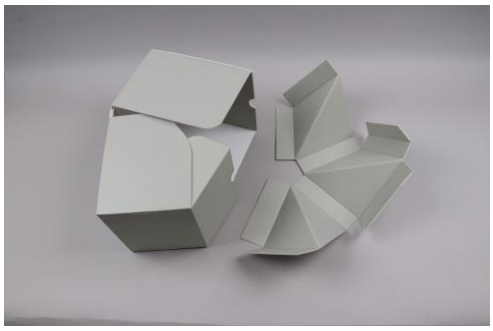


Fig 13. Collection box with the volumes placed into the divider unit[46]
Fig. 14. Collection box and its loosely folded two-piece divider unit for six volumes with different thickness



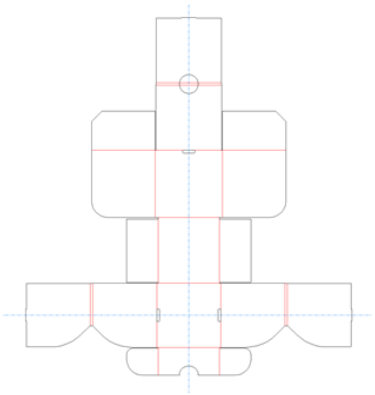


Fig. 15. Collection box with its loosely folded one-piece divider unit
Fig 16. Collection box with the one-piece divider unit placed in it for separation of four volumes with different thickness
Fig 17. Collection box template ArtiosCAD design phase

The biggest challenge was to create an Album-box with a built-in book cradle for display for an object weighing ten kilograms (Fig. 18.). This container has folding sides (Fig. 19.) and built-in grooves where the sides of the cradle can be secured as the album is open during display. The base

[46] The artefact is: *Vörösmarty' minden munkái.* Kiadták barátai Bajza J. és Schedel Ferencz. Pesten, Kilián György' tulajdona, 1845-1848. It is located in: NSZL General Collection. Shelfmark: Kossuth L. 1171/1-10=90

unit of the book-cradle precisely matches the dimensions of the book spine, it provides a robust, custom-made base unit (Fig. 21.) on which the spine securely rests when it is opened the fragile spine cover of the book is not touching the bottom of the base unit, but the volume is supported on boards by the book joint. The cradle itself provides a suitable opening angle. This prevents the book from being forced open, avoiding overstretching the spine. To assist with opening the box, removing the album, and setting up the book support, an instruction guide containing photographs is included inside the enclosure. Furthermore, it is noted that the box could be handled opened by a conservator. So far, this project was the most time-consuming of all, and it was carried out in close collaboration with a fellow conservator[47].

Fig. 18. Album-box with the installed book cradle, which gives a strong support for display[48]
Fig 19. Album-box with its folded sides and collapsed book cradle

A simpler version of the box with a built-in book-cradle was designed for another album (Fig. 20.). In this version the book cradle has a simpler design, making it easier to recreate. This type of box is more suitable for books with less sensitive spine covers, however, the opening angle can still be determined in advance. On the photographs below we can compare the spine support of the simpler display box and the robust spine support structure of the previously described album-box.

[47] The realisation of the box was made together with paper and leather conservator Rebeka Kovács. She was the specialist, who carried out conservation on the artefact as well.
[48] The artefact is: *Schunda Venczel József díszalbuma*. It is located in: NSZL Theatre and Music Department.Shelfmark: Zenei arcképgyűjtemény 56. Earlier referred with shelfmark Zenei arcképcsarnok 56.

Fig. 20. The simpler version Album-box with the built-in book-cradle[49]
Fig. 21. The base unit of the more complex Album-box

We received a unique request to create a box for a paper scroll (Fig. 22.). The box design was based on a template from the Standard catalogue, but we had to find a solution for securely holding the scroll without it touching the box. Two U-shaped paper inserts were adhered inside the box, to hold the acid-free roller on which the scroll is rolled (Fig. 23.). This project was also carried out in collaboration with a fellow conservator[50].

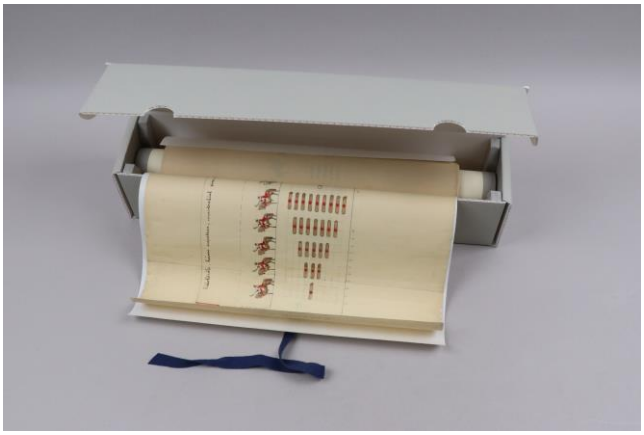


Fig. 22. Scroll-box with the inserted object support roller[51]
Fig, 23. Scroll-box and its separated roller, making the U-shape paper insert visible

It was a rare occasion to create a box specifically for phonograph cylinders (Fig 26). The decision was made to house the related cylinders in one box, while keeping them individually separated (Fig. 25.). We used a compartmental box template from the Standard catalogue, but altered the design to fit the needs of the objects in question (Fig. 24.). The box is strong, and the objects are easily removable from the compartments one-by-one.

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[49] The artefact is: *Borhy György: Egy magyarországi középbirtok rövid leírása*. Budapest, Révai és Salamon. 1904. NSZL General Collection. Shelfmark: 410.955=90/a
[50] Paper and leather conservator Ágnes Novotny - who treated the artefact - requested the special box, and the design was based on her idea. She also adhered the added parts of the box interior.
[51] The artefact is: *A Szent István-év megnyitó ünnepi felvonulásának rajza / Jaschik Álmos.* Budapest, 1937. It is located: NSZL Theatre and Music Department. Shelfmark: Limbus Jaschik Álmos 24.

Fig. 24. Compartmental box
Fig 25. Compartmental box for phonograph cylinders[52]
Fig 26. A phonograph cylinder

Another simple resourceful solution was created for a group of Four flap folders that contain tutorial steps on book conservation methods (Fig. 27.). As the objects which are in different phase of conservation process need to be kept together, we created a compartmental storage box for them. Inside each compartment we cut a layer of corrugated board, which have fabric tape loops attached, aiding easy lifting and removal of the four flap folders.

Fig. 27. Compartmental storage box Four flap folders[53]

We received a request to recreate a box shape that was used years ago for storing glass plate negatives (Fig. 28). At that time, it was an undivided unit, made from cardboard, with the sides secured by a metal closure. We made the new version of this box entirely from corrugated board, with an internal divider (Fig. 30) which makes the separation of the glass plate negatives easier (Fig. 29.). The box firmly and gently holds the series of glass plate negatives, and can be prepared in any given size.

[52] The artefact is: *Volly István-hagyaték.* It is located: NSZL Theatre and Music Department. Shelfmark: FO 60-80
[53] The artefact is: *Félbőr kötés restaurálása.* It is located: NSZL Preservation and Conservation Department. Shelfmark: H. rel. 1334

Fig. 28. Full packed Glass plate negative box[54]
Fig. 29. Glass plate negative box with divider
Fig. 30. The interior of the Divided glass plate negative box

A Vertical compartmental box was created for a set of small volumes (Fig. 31.) that, when placed side-by-side on the shelf, took up too much space. Therefore, the decision was taken to store them in two rows inside a taller box. The inner unit is a modified version of a Standard catalogue template, and the box is a version of the previously used example.

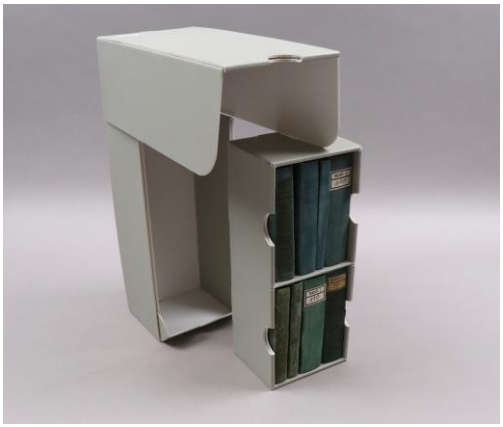

Fig. 31. Vertical compartmental box[55]
Fig. 32. A three-piece Fond box

Recently a three-piece Fond box (Fig. 32.) was made in-house, in this design the elements are attached with bookbinding canvas adhered in place. Work on this box was completed by the institution's bookbinders, who carefully joined the accurately cut elements. The work resulted in a tightly closing storage unit for archive documents, with a folding lid and front panel which makes the stored item easily removable.

[54] The artefact is: *Üvegnegatívok a Babits-Török Sophie-hagyatékból.* It is located in: NSZL Manuscripts Department. Shelmark: Fond III/2332/002-0049
[55] The eight-volume artefact is part of the Kossuth Collection. It is located in: NSZL General Collection. Shelfmark: Kossuth L. 110/1-8=90

In addition to the examples presented, we use other types of boxes as well. New ideas are constantly emerging on how to recreate old box shapes, and how to improve and alter our tried and tested designs. We are still in the process of testing templates from the Standard catalogue (Fig. 34.). Additionally, there is an increasing need for new designs in the institution. Some of them are related to single sheet documents, cartography items (Fig. 33.), music records, big size posters and the list goes on.

Fig. 33. Base of a two-piece Standard catalogue box for big items, made from corrugated board, in this case with a raised-relief map inside[56]
Fig. 34. Standard catalogue two-piece box, made from prespan pressboard

Added advantages of the new box making method

As mentioned earlier, preventive conservation of the collections is a more sustainable solution compared to solely relying on conservation-restoration measures. It is very important to provide protective storage boxes for those items that need it. As the mechanised packaging system is readily available in our institution, it allows us to reduce the time required to rehouse more of our artefacts into suitable storage units[57]. Having its own machine and design station to create the boxes, the institution can achieve a more sustainable approach to box making. As discussed, the 3D modelling display function of the design software can save time and material by eliminating the need to cut a template while it is still in the design phase. With the Layout function of the cutting program, we can optimize the use of materials. Unlike humans, the machine always cuts the templates with perfect precision, ensuring that we do not use excess materials unnecessarily. Therefore, transfer to digital technology and automation help reduce waste during the process. The waste materials from the machine are given to the institution's bookbinders, where they get a chance for a second life. The paper waste from their work is collected for recycling.

We like to integrate this eco-friendly perspective into the workflow. We develop the designs after careful consideration of the cutting lines, bearing in mind that using curved lines instead of sharp angles will make the finished folded boxes more durable by preventing premature tearing of the material. We do not operate the machine daily, instead, we use it on a project basis, waiting until a larger number of items are ready for processing. We take good care of our equipment and tools, which

[56] The artefact is: *Monte Etna*. It is located in: NSZL Maps, Posters and Small Prints Department. Shelf mark: TD 160. The size of it is: 93,5x83x15 cm.
[57] On an 8 hour workday we can produce 40-60 pieces of boxes, depending on the type of template.

extends their lifespan, and reduces the need to replace them frequently. We also plan to use new, more durable tools in the future, which better stand the test of time.

The in-house packaging preparation system has an indirect impact on the protection of our environment as well. We do not have to order boxes from another company, and we stock a large quantity of materials on-site, so we need less frequent deliveries. By reducing our transport needs, we are reducing both our costs and harmful fuel emissions. We are currently not aware of acid-free corrugated boards being manufactured in Hungary, so we must source it from abroad. However, we constantly monitor developments in the paper manufacturing industry in order to switch to local manufacturers as soon as possible, thereby reducing the environmental impact of transportation.

Experiences, possibilities, conclusion

As the collection of the National Library contains many different types of objects, with varying shapes and measurements, we aimed to find an in-house solution for preparing custom boxes tailored to their unique preservation needs. Although we continue to order expansion folders from a local supplier, and we have skilled colleagues who can create boxes by hand, operating this packaging preparation system has proven to be a good decision. This system is particularly useful when we wish to produce a large number of unique boxes or quickly prepare custom-made boxes in-house for our composite and irregularly shaped artefacts.

Operating a packaging preparation system is a complex task which requires knowledge of materials, technical skills, creativity, patience, and the ability to work collaboratively. In order to exploit the innovative potential of the software, it is worth following the regularly available webinars[58], due to the continuous improvements. On the webinars we can learn about new tools, new solutions, and deepen our knowledge in the field. The possibility to add new tools to our system can expand our options in box-making. Regular professional maintenance of the system is crucial, as is the provision of the required climatic conditions for both the machine[59], and the materials we work with. The possibility of cloud-based planning can open new opportunities in work organisation. The purchase of such a system is costly, but the production of locally made boxes offers a return on this investment.

With the help of the software and the cutting machine, we are able to create storage units using unique methods, combining technology and creativity. With our innovative packaging system, we produce state-of-the art containers for our artefacts and documents at the NSZL. By following the continuous development of the software and the cutting table, and by connecting to knowledge bases, the system can help the institution stay up-to-date with the latest trends in packaging technology. This system also enables our institution to become more sustainable. The packaging preparation system has a measurable impact on the modernisation of the National Széchényi Library's preservation processes.

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[58] Webinars are freely available to Esko ID holders. Information on this is available at https://www.esko.com/en/support/blendedlearning (06. 04. 2025.)

[59] The expected temperature in the cutting machine environment during operation is +10˚C... +30 ˚C, humidity: 30 - 80% RH. The accuracy of the system is determined at +20°C and 50% RH. The expected operating temperature in the environment of the vacuum pump, located in a separate room, is +0 °C to +30 °C and the humidity is 30 to 80% RH. In: *X22 Production Machines. Site Preparation Guide*. 08-2022 Kongsberg Precision Cutting Systems. Document no: D3626.

ԱՄՓՈՓՈՒՄ

Հունգարիայի ազգային գրադարանը եղել է գիտելիքի շտեմարան և հունգարական մշակութային ժառանգության կենտրոն: Հոդվածում ներկայացվում է գրադարանի համանման փաստաթղթերի հավաքածուի և դրանց ոչնչացման կամ քայքայման գործընթացը կանխող միջոցառումների փորձը: Հավաքածուն ներառում է տարբեր նյութերից պատրաստված և պահպանման տարբեր մոտեցումներ պահանջող միավորներ: Մեքենայացված մեթոդների կիրառումը թույլ է տալիս մշակել արժեքավոր փաստաթղթերի պահպանման հատուկ լուծումներ: Հունգարիայի ազգային գրադարանն օգտագործում է փաթեթավորման տեխնոլոգիաների պատրաստման և ներմուծման համար նախատեսված մեքենաներ: Հոդվածում նկարագրվում է համակարգի կողմից առաջարկվող հնարավորություններն ու լուծումները, ինչպես նաև դրա ազդեցությունը գրադարանային ֆոնդերի պահպանության արդիականացման վրա:

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Photographs (Fig. 25., Fig. 26.) were taken by Ágnes Novotny. The rest are the author's own photographs.

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