Tenth Annual JAT Contest for New and Aspiring Translators (Japanese to English)

Source Text

数億年以上のデータ保存に向けたストレージ技術

http://assets.jat.org/documents/contests/JAT%2010th%20Contest%20JtoE%20Text.pdf

The translations of award winners and finalists

First-place winner	E17 Kamil Spychalski		
Second-place winner	E5 Colin Wilson		
Finalists	E13 Heidi Christian	E33 Natalie-Anne Hall	E37 Keith Krulak

E13 Heidi Christian

1 | Introduction

Of records kept on paper, stone, clay tablets and the like, some have existed for several thousands of years (Table 1). Compared with these, the ever higher-capacity, lower-cost solid state hard drive or optical digital media of today is extremely fragile(1). It must be kept from extreme temperatures and humidity, and the lifespan of the data is a short 10 to 100 years. In addition, because advances in technology are so frequent, there is concern that the hardware needed to retrieve the data will no longer be produced in the future. Some hold the opinion that it would be best to copy the data to the next new medium in a perpetual cycle of data migration, but if the process were to be interrupted even once, the data would be lost forever.

Therefore, there is a need for a storage technology that is impervious to deterioration over time, fireproof and waterproof, from which data can be retrieved in any era, especially for items like cultural artifacts and historical documents that people wish to preserve permanently.

In 2009, we showed that information recorded on fused quartz had a lifespan of several hundred million years (at room temperature)(2). Fused quartz is a hard glass with extremely few impurities, is chemically stable, highly resistant to chemicals, and resilient to radiation. In addition, it has the exceptional quality of being highly heat resistant and resilient to sudden changes in temperature.

For the current project, working jointly with the Miura Laboratory at Kyoto University, we developed a technology to record a large amount of bit information at one time into layers of fused quartz, and confirmed the ability to retrieve the information in the form of digital data via a low-power microscope and simple image processing(4)(5).

2 | Recording and Retrieval Methods

To record data, we use an ultrashort pulse laser called a femtosecond laser (Figure 1). The duration of the pulse of light this laser emits is extremely short, approximately 100 femtoseconds (a femtosecond is one-quadrillionth or 10-15 of one second, so 100 femtoseconds is equal to 10-13 of one second). By concentrating the light energy into this ultrashort period, it is possible to alter the refractive index of microscopic areas within the transparent fused quartz without causing it to crack from thermal shock. Digital information can be recorded by designating locations where the refractive index is altered as "1" and locations where the refractive index is not altered as "0".

The recording device we developed for the current project employs a device called a "phase modulator" to make it possible to record 100 bits at once by converting each pulse into 100 separate pulses (Figure 1).

For retrieval, we developed a system that can be recreated even in the distant future (Figure 2). Using a low-power microscope, we image the inside of the fused quartz, process the signal to emphasize the aforementioned altered areas, and then apply a high signal-to-noise ratio to retrieve the digital data.

In Figure 3, we show an example of data retrieval. We image the recorded pattern with a low-power microscope at 20x magnification, and after signal processing it is retrieved in the form of digital data. This signal processing is something that can be performed with a standard PC in a short amount of time, and paired with low-power photography, it is thought that this system could be easily recreated even in the distant future.

To ensure that the data can be retrieved in the distant future, it is thought that recording the data along with an analog image that demonstrates the format and method of signal processing would be helpful. This would include an explanation, for example, that by altering microscopic areas of the glass that correspond to digital data bits, it is possible to record data as a pointillized image.

During the tests we performed for the current project, we recorded a test pattern like the one in Figure 3 onto a maximum of four layers inside a piece of fused quartz 2 mm thick. When we recorded four layers, the bit density of the surface was 40 MB/inch2, which is greater than the 35 MB/inch2 bit density of a CD. In addition, the sample we tested in 2009 was estimated to have a lifespan of 300 million years at room temperature based on the deterioration we saw at 700°C and 900°C. However, by optimizing recording conditions, we confirmed that there was no deterioration in the image data after even more intense heat testing (2 hours at 1000°C). Based on this, the fused quartz is expected to be nearly semipermanent if kept at room temperature(4)(5).

E33 Natalie-Anne Hall

1. Introduction

Some information recorded on stone, clay or washi paper has survived thousands of years (see Table 1).

Contemporary digital data storage mediums, however, such as semiconductors, hard disks and optical disks, in constant pursuit of higher capacity at a lower cost, are extremely fragile1. These devices require temperature and humidity monitoring and data stored on them has a short lifespan of just 10 to 100 years. They are also quickly replaced by new technologies and there are concerns that we will one day become unable to replicate the hardware required to retrieve the data stored on them. Some believe that it is simply a matter of continuously copying or 'migrating' data to new storage mediums. However, all it takes is for this cycle to be broken and the data is lost.

For this reason, we need storage technology that will not weather with heat or humidity, and that is exceptionally fireproof and waterproof, to allow stored data to be retrieved at any time in the future. This is particularly important for things we want to permanently preserve, such as cultural heritage and historical archives.

We at the Hitachi Central Research Laboratory have in 2009 proven the potential of data stored on fused silica to survive several hundred million years at room temperature. Fused silica is tough and of high purity. It is chemically stable and highly chemical and radiation resistant. It is also extremely heat resistant with the ability to withstand sudden changes in temperature.

In our latest work, we have teamed up with the Miura Laboratory at Kyoto University to develop technology capable of simultaneous multi-bit recording within fused silica. Our teams have proven that this can be read as digital data using a low-power microscope and simple image processing technology.

2. Recording and reading data

The recording process uses an ultrashort pulse laser called a femtosecond laser (see Figure 1). The duration of each pulse of light is extremely short - approximately 100 femtoseconds (1 femtosecond is equal to 1 quadrillionth of a second, meaning 100 femtoseconds is the equivalent of 1 ten-trillionth of a second). Concentrating light energy in such a short period of time allows refractive-index modification of a minute area within the transparent fused silica without causing heat-induced fractures in the glass. Digital information is recorded by treating refractive-index-modified areas as binary '1' and unmodified areas as '0'.

The storage device developed uses what is called a 'phase spatial light modulator', which by modulating one pulse into 100 pulses allows for simultaneous recording of 100 bits of data (see Figure 1). It was developed such that stored information may be retrieved even in the distant future (see Figure 2). Digital data is read at a high S/N ratio, by photographing the inside of the fused silica using a low-power microscope and using signal processing to enhance the modified area.

Figure 3 shows how data can be read. The recorded pattern is photographed with a 20x microscope, signal processed and retrieved as digital data. This signal processing is simple enough to be performed quickly by a standard PC and, together with low-power microscopic photography, we theorize such data can easily be read even in the distant future.

We believe that the most effective way of ensuring the ability to retrieve data long into the future is to

record an analog image showing the format and signal processing method alongside the data. These analog images can be recorded as pin-point sketches by modifying a minute area equivalent to one bit of digital data.
In our latest trial, we successfully recorded a test pattern like the one in Figure 3 on 4 layers within 2mm-thick fused silica. The recording density of this 4-layer storage was equivalent to 40 MB/inch2 ? greater than that of a compact disc (35 MB/inch2). Furthermore, recording conditions in the current sample have been optimized. As a result, in contrast with the results of our 2009 sample, which gave an estimated lifespan of 300 million years at room temperature after degradation from exposure to temperatures of 7000C and 9000C, the image data used for information retrieval in the current sample proved to have no degradation in lifespan after being subjected to even harsher conditions of 10000C for 2 hours. We therefore estimate the lifespan at room temperature of data stored using this method to be semi-perpetual.

E37 Keith Krulak

A Storage Technology for Hundred-Million-Year Preservation

1. Introduction and Summary
Of the written records that used Japanese paper, stone, or clay tablets, some have survived in excess of several thousand years (Table 1). In contrast, modern recording media for digital data that seeks mass storage and low cost, such as semiconductors, hard-disc drives, and digital optical discs, are extremely fragile. It is necessary to control temperature and moisture, the life of the data is a short 10 to 100 years, and furthermore, the hardware to reproduce the data may not exist in the future because of frequent generational changes of this technology. Some view that endlessly performing “data migration”?copying the data to new media?will suffice, but data will be lost if there is any interruption.
Thus, there is a need for a storage technology, especially for permanent preservation of cultural heritage assets and historic archives, that ensures no data degradation from temperature or moisture, possesses superior heat- and moisture-resistance, and permits future generations to read the recorded data.
We at Hitachi Central Research Laboratory showed in 2009 that it was possible for information recorded in fused silica glass to survive several hundred million years at room temperature. Fused silica, which is hard and has extremely few impurities, is chemically stable, highly resistant to chemical change, and is robust even against radiation. Furthermore, it is highly heat resistant and durable against sudden changes of moisture.
Together with the Miura Laboratory of Kyoto University, we developed the technology to record in bulk multiple bits of information inside fused silica and confirmed that it could be read as digital data using a low-power digital microscope and basic image processing.

2. Methods of Recording and Retrieval

To record data we use a short pulse laser called a femtosecond laser (Figure 1). The light pulses emitted by this laser are of extremely short duration, about 100 femtoseconds. (A femtosecond is one quadrillionth of a second; 100 femtoseconds is 10 trillionths of a second.) By concentrating light energy in such ultra-short bursts, it is possible to change the refractive index of a micro-region inside of the transparent fused silica without causing heat cracks. Digital information can be recorded by regarding spots with a changed refractive index as “1” and unchanged spots as “0”.

With the recording equipment developed for this trial, it was possible to record 100 bits simultaneously by transforming one light pulse into 100 beams utilizing an instrument called a “spatial phase modulator” (Figure 1). We developed a retrieval method to permit reproduction in the distant future (Figure 2). We took an image of the inside of the fused silica utilizing a low-power digital microscope and then used signal processing to sharpen the altered micro-regions described above. The digital data can be read with a high signal-to-noise ratio.

Figure 3 shows an example of data retrieval. The recorded pattern is imaged at 20x magnification with a low-power microscope and, after signal processing, is retrieved as digital data. Such signal processing can be done in a short time using an ordinary computer, and together with low-power magnified imagery, we think that even in the distant future this procedure can be performed easily.

To guarantee retrieval in the distant future, we think it will be effective to record the data along with an analog image that indicates the format and method of signal processing. It was possible to record this analog image, for instance, as a dot image using micro-alteration of regions corresponding to digital bits.

In this experiment, we recorded a test pattern similar to that in Figure 3 in four layers within fused silica 2mm thick. The capacity of the four layers was equivalent to 40 MB/inch2, in excess of that of a CD of 35 MB/inch2. Furthermore, it was estimated that the 2009 sample would last 300 million years at room temperature judging from the data degradation at 700° and 900° Celsius. We verified in this experiment that there was no degradation in the image data used for retrieval even after more extreme heat testing (1,000° C for 2 hours). From this, we predict that the life of the recorded data at room temperature is nearly semi-permanent.

E5 Colin Wilson

1. Introduction

Information written on paper, clay tablets or in stone can last for thousands of years (Table 1). High-volume, low-cost modern data storage media, on the other hand, such as semiconductors, hard discs and optical disks, are not nearly as durable.1 These media must be protected from changes in humidity and temperature and can store data for a maximum of only 10 to 100 years. Such devices are also subject to rapid generational turnover, raising the question of whether the hardware necessary to read the information will still be available in the future. Although it could be argued that this problem can be solved by perpetual data migration, continually copying information to new media, if even one link in that cycle were ever to break, the data could be lost forever.

There is some data, however, such as cultural and historical information, that is particularly important to preserve more permanently. Such data demands storage technology that will not deteriorate over time due to temperature or moisture and can withstand fire and water, so that it can be read for ages to come.

In 2009, we demonstrated the potential of fused silica glass as a medium for recording information that can last for hundreds of millions of years at room temperature.2 Fused silica glass is very hard, extremely pure, chemically stable and highly resistant to chemical and radiation damage. It also displays excellent resistance to damage from heat, even when subjected to extreme temperature fluctuations.

In collaboration with the Miura Laboratory3 at Kyoto University, we have now developed technology to write digital information in large batches of bits inside fused silica glass crystals. This information has been successfully read back using a low-power microscope and simple image processing.4, 5

2. Writing and Reading

Bits are written with a femtosecond laser, which can produce extremely brief laser pulses (Figure 1). The pulses of light emitted by these lasers are only about 100 femtoseconds long. One femtosecond is one quadrillionth of a second, meaning that 100 femtoseconds, the duration of a laser pulse, is just one ten-trillionth of a second. By concentrating the burst of energy into such a short time, it is possible to change the refractive index of minute regions inside a transparent silica glass crystal without causing the crystal to crack due to heat. We are able to thus store and retrieve digital information by reading regions with altered refractive indices as “1” and regions that are unaltered as “0.”

Using a spatial light modulator6 we have now been able to convert one laser pulse into 100 pulses, enabling the simultaneous recording of 100 bits (Figure 1). We have also developed a method to read this information that is likely to be usable even in the distant future (Figure 2). First, the interior of the silica glass is photographed through a low-power microscope. Signal processing is then used to enhance the image of the altered regions. Data read by this method has a very high signal-to-noise ratio.

An example of the steps in the reading process is shown in Figure 3. As the figure shows, the recorded pattern is photographed at 20x magnification using a low-power microscope. The image then undergoes signal processing, a task simple enough to be performed quickly by an ordinary personal computer, after which the data can be read. This simple set-up could likely be assembled even in the distant future.

To ensure that this data can always be read, it is important to accompany it with analog images explaining the format and signal processing method. Such images could even be rendered in a sort of pointillism on the same minute scale that bits are written.

In these experiments, up to four layers of patterns like the one shown in Figure 3 were written inside fused silica glass crystals two millimeters thick. With information recorded in four layers, these crystals reached a storage density of 40 MB/inch2, higher than that of a CD at 35 MB/inch2. The samples produced in 2009 degraded when heated to temperatures between 700°C and 900°C, from which it was estimated that they would last around 300 million years at room temperature. This time, by optimizing writing conditions, we were able to read from crystals subjected to even more extreme heating: the data did not degrade even after two hours at 1000°C. From this we predict that, stored at room temperature, data stored in these crystals could last virtually indefinitely.

E17 Kamil Spychalski

1. Introduction

Some records made on materials such as stone, Japanese paper or clay tablets still exist today after standing the test of time for thousands of years (Table 1). In contrast to these, modern digital storage media such as solid-state, hard disk and optical disk drives, which pursue high capacity and low cost, are extremely delicate(1). Even with the necessary temperature and moisture control, the lifespan of the data is a brief 10 to 100 years. With frequent generational shifts, there is also a concern that hardware needed to read the data will become unavailable in the future. While some believe that 'data migration', a transfer of data to new media, could be perpetually repeated, even a single interruption would result in all this data being lost.

Particularly in areas such as cultural heritage or historical archives where permanent storage is desirable, there is a need for water/fire-resistant storage technology that allows data to be stored and retrieved at any time over the course of human history without deteriorating due to temperature or moisture.

In 2009, we showed that it is possible for information recorded on quartz glass to have a life span of hundreds of millions of years (at room temperature) (2). Quartz glass is a hard, chemically stable glass with very few impurities, which is also resistant to chemicals and radiation. It also has other outstanding attributes, including high heat-resistance and a resilience to sudden changes in temperature.

This time, in collaboration with Kyoto University's Miura Laboratory(3), we developed technology for batch recording large volumes of binary information on the interior of the quartz glass, and have confirmed that it can be read as digital data by a low-power microscope and simple image processing(4)(5).

2. Storage and Retrieval Methods

An ultrashort pulse laser, known as a femtosecond laser, is used for recording (Figure 1). The pulses of light emitted by the laser have an extremely short duration of approximately 100 femtoseconds (a femtosecond is equal to 10?15 of a second, so 100 femtoseconds equal 10?13 of a second). By concentrating light energy for such an ultrashort time, it is possible to modify the refractive index of microscopic areas within the transparent quartz glass without causing cracking due to heat. By assigning a value of '1' to areas with a modified refractive index and '0' to those unchanged, it is possible to record digital information.

The recording equipment we developed this time utilizes a device known as a 'spatial light modulator'(6) to convert one pulse into 100, enabling 100 bits to be simultaneously recorded (Figure 1). The method of data retrieval was developed such that it can be reproduced even in the distant future (Figure 2). It utilizes a low-power microscope to photograph the interior of the quartz glass, from which the digital data is retrieved with a high S/N ratio by emphasizing the above-mentioned modified region through signal processing.

Figure 3 indicates an example of data retrieval. The recorded pattern is photographed using a 20x microscope and read as digital data following signal processing. This signal processing can be performed in a short time on a standard PC and, combined with the low-magnification photography, is a method we consider easily reproducible even in the distant future.

We believe that recording an analog image indicating the format and method of signal processing is an effective way to ensure the data can be accessed in the distant future. This analog image could be recorded as dots, for example, by utilizing the microscopic modified areas corresponding to bits of digital data.

In the most recent experiment, we recorded up to 4 layers of test patterns, such as those in Figure 3, inside 2mm-thick quartz glass. When recording 4 layers, the planar recording density was equivalent to 40mb/inch2, exceeding the 35mb/inch2 recording density of a CD. In addition, while the deterioration of the 2009 sample at 700°C and 900°C led us to estimate a room temperature lifespan of some 300 million years, the current optimization of recording conditions allowed us to confirm no loss in the image data used for retrieval following even more severe heat testing (2 hours at 1000°C). This leads us to expect a semipermanent lifespan at room temperature(4) (5).

Commentaries from the Judges

James Davis

General Comments

One requirement for a successful translation is background knowledge of the subject at hand. Many people recognize this fact in the context of scientific, medical or technical translation, but this point is equally valid for other specialties, such as financial, legal or political translation. This year's Japanese-into-English contest passage describes a technical innovation. In order to successfully translate such a passage, it is not necessary to be an engineer, but it is certainly helpful to be able to write for an audience of engineers.

The specific product described in the passage is new. However, a considerable amount of information is readily available about the various elements of the product and the underlying concepts behind those elements. Online research and background reading can quickly help the translator learn enough about the materials, the methods and the concepts included in this passage to be able to present the content accurately and in the manner that would be expected in an English-language document on the same subject.

Thanks to everyone who submitted a translation for this year's contest, and congratulations to all five of the finalists! Each of the finalists did an excellent job on certain aspects of the document. When evaluating a translation, the first priority must go to accuracy. If there are errors related to content, the translation is flawed. A knowledgeable reader can overcome awkward syntax or overly literal renderings of figures of speech, but errors related to content are often difficult—and in some cases, impossible—for the reader to detect. For example, the source text included a reference to 和紙. Some contestants translated this term as "Japanese paper." Other people transliterated this term as "washi." However, some people simply translated 和紙 as "paper." There is no way for the reader of the translation to know that the original document referred specifically to 和紙 rather than some other variety of paper. When 和紙 is translated as "paper," information is lost. Generally speaking, a loss of information in a translation is a weakness. It may be a major weakness or a minor weakness, but it is a weakness, and any weakness reduces the value of the translation. Comments on each of the translations follow.

E5

The translator writes with a very engaging style, but errors and omissions reduce the value of the translation to a potential reader. For example, in several places the translator refers to "silica glass crystals," "crystals" or "crystal." In fact, glass is not crystalline at all—it is amorphous. Two minutes of background reading about "glass" in Wikipedia would have made this distinction clear. Such an error immediately lowers the credibility of the translation in the eyes of a knowledgeable reader. In several of the paragraphs in Part 2 the translation provides an accurate summary of the content, but details that are present in the source text are missing in the translation. The quotation marks that surround 空間位相変調器 in the first sentence of the second paragraph in Part 2 of the source text are absent in the translation, as are the superscripts for references (4) and (5) at the end of the final sentence in Part 2.

One important aspect of translation is the need to write in a style and tone that match the type of document in question. Before tackling a translation assignment it is often helpful for the translator to read examples (in the target language) of the kind of document that is to be translated. The contest instructions indicated that this document appeared in the monthly journal of a professional society for engineers in the auto industry in Japan. Thus, it would be helpful to skim a few articles from a comparable journal in the U.S. or some other English-speaking country. In this instance journals published by SAE International would be excellent models.

The translation rests on a solid foundation. Greater attention to detail and the adoption of a style that is more suitable for this type of document would make the translation more valuable.

E13

This translation includes a number of well-turned phrases but suffers from a lack of familiarity with the content and from some difficulty in recognizing grammatical patterns. In the first paragraph the phrase "ever higher-capacity, lower-cost" concisely expresses two of the most significant trends in digital media over many decades, but the phrase "solid state hard drive or optical digital media of today" combines three distinct categories (半導体、ハードディスク、光ディスク) into two. It is not clear whether the translator simply omitted a comma, or whether the translator actually thought there were only two categories. In fact, the 半導体 portion refers to flash drives or thumb drives, which employ semiconductor-based materials but have no moving parts. These items are clearly different from hard disks (which employ magnetic technology) and optical disks (which make use of laser technology). This portion could read, "modern digital storage media—such as solid-state drives, hard disks and optical disks" or "modern digital storage media—such as semiconductor-based drives, hard disks and optical disks."

The final sentence in the second paragraph of Part 2 includes the phrase デジタルデータを高い S／N 比で読み出す. This phrase appears as "..., and then apply a high signal-to-noise ratio to retrieve the digital data." The particle で often indicates the means by which an action is carried out, but a quick look at the Wikipedia entry for "signal-to-noise ratio" confirms that this ratio is one measure of the quality of a signal. The appearance of 信号処理によって in this sentence indicates that 信号処理 is the means by which the S／N 比 of the output signal is increased. The inclusion of 上述の変性領域を強調することで provides additional detail as to how this increase is accomplished. A better alternative for the portion in question would be, "..., and then read out the digital data with a high S/N ratio."

The fourth paragraph in Part 2 deals with the creation of an analog image that will explain to future generations the way in which the digital content was originally recorded. The second sentence explains how the analog image might be created. Thus, the implied direct object of the verb 記録する is not "data." Rather, it is "the analog image." The second sentence could read, "It is possible to record this analog image as a collection of dots, with each dot being a microscopic region with a refractive index that was modified following the same procedure that was used to record one bit of digital data." In this instance the best approach may be to understand the content of the source text and then present that content as clearly as possible, rather than trying to follow the exact structure of the original Japanese sentence.

E17

This is an excellent translation. Almost all of the content is rendered accurately, the translation is well written, and the style is one that a reader of such a document would expect. The translator paid attention to detail, and that is an extremely important trait in any field of translation. Here is one suggestion:

In the second sentence of Part 1 the phrase 大容量・低コストを追求している becomes "..., which pursue high capacity and low cost." Use of the word "pursue" could make the reader wonder whether the goals of 大容量 and 低コスト have ever been (or will ever be) attained. In fact, significant progress has been made in both respects, and progress continues today. A better alternative might be, "..., which pursue ever greater capacity and ever lower cost" or "...., which provide ever greater capacity and ever lower cost." Either of these options would indicate that progress has been made, but the quest is not over.

E33

This translation is somewhat uneven. In some places the translator clearly understood the content and rendered a crisp and natural-sounding translation. In other places it appears that the translator simply picked the first option provided by a glossary, without really understanding the context. For example, "contemporary" is a good translation for 現代 in the context of history or the arts, but 現代のデジタルデータの記録媒体 should be "modern storage media for digital data" or "modern digital storage media." In the context of paint or other materials that are exposed to the elements it makes sense to translate 劣化 as "weathering," but for the products described in this document, "degradation" due to heat or humidity seems more reasonable. It should be noted that when 劣化 appears again in the final paragraph of Part 2, the translator does use the term "degradation." Rereading the entire translation (for consistency and overall impact) during the editing process might have allowed the translator to notice this discrepancy.

The 石英ガラス is described by the authors as 固く. For a solid such as 石英ガラス the best translation for 固い is "hard" in the sense that the material resists deformation. In the context of materials testing the word "tough" normally means that the material can absorb a large quantity of energy before failure. In this context "hard" is clearly the intended meaning.

The last sentence in Part 1 reads, "Our teams have proven that this can be read as digital data using a low-power microscope and simple image processing technology." Most readers will probably not know what "this" actually refers to, and perhaps the translator was not completely sure, either. In the first half of the original Japanese sentence the noun ビット情報 appears as the direct object of the verb 記録する, which modifies the noun 技術, which in turn is the direct object of the verb 開発し. If ビット情報 is what the system will 記録する, then this same ビット情報 is probably what the system can 読み出す. If so, the second half of the final Japanese sentence in this paragraph could read, "We have confirmed(4)(5) that this information can be read out in the form of digital data through the use of a low-power microscope and simple image processing." It is worth noting that the superscripts for references (2) through (6) were omitted from this translation. References may be troublesome, but they must be included in any translation.

E37

This translation would benefit from greater attention to detail. The content of the introductory portion is generally well done, but there are significant errors. The heading for Part 1 is はじめに, which is rendered as “Introduction and Summary.” There are certainly instances in J-into-E translation when some degree of rewriting or the insertion of additional words becomes necessary, but this is not one. “Introduction” is acceptable; “Introduction and Summary” is not. (A quick look at Part 3 of the document reveals that a separate “Conclusion” section already exists.)

The final sentence in the third paragraph of Part 1 refers to 急激な温度変化, but the translation cites “sudden changes of moisture.” Although both the word 温度 (temperature) and the word 湿度 (humidity) appear in the first paragraph, this sentence refers specifically to “sudden changes in temperature.” Furthermore, in this translation all of the superscripts [(1) through (6)] for the references were omitted. Many translators adopt a two-stage editing process: carefully editing the translation while comparing the translation against the source text (on a line-by-line or sentence-by-sentence basis) and then rereading the entire translation without looking at the source text. This type of editing process can be effective in reducing the number of misread kanji and the number of omissions.

In the final sentence of the fourth paragraph in Part 1 the authors tell us that the information that has been recorded is read out using 低倍率の顕微鏡と簡単な画像処理. The translation mentions that the authors used “a low-power digital microscope and basic image processing.” The authors do not state whether the microscope is digital or analog, but Figure 2 indicates that a digital camera is attached to the microscope.

Thus, the microscope does not have to be digital in order to obtain a digital output. Unwarranted assumptions can reduce the value of a translation, particularly in a legal or technical context. In this instance, “a low-power microscope and basic image processing” is really as far as we can go. In the second paragraph of Part 2 the translator again refers to a “low-power digital microscope,” even though text simply mentions 低倍率の顕微鏡, but in the third paragraph the translator reverts to “low-power microscope.” The type of editing process mentioned above is also useful for maintaining consistency in long documents.

In the first sentence of Part 2 the authors mention a 超短パルスレーザ. The translation mentions a “short pulse laser,” but that does not accurately describe the device in question. The kanji 超 is frequently rendered as “super” or “ultra,” and any online glossary would indicate that 超短 should be “ultrashort.” The translator writes well. Errors of the type described here can be eliminated by careful reading of the source text, drawing information from all portions of the document in question, making use of a variety of glossaries or other references, and careful editing.

Ruth McCreery

"Field-specific knowledge" has been a JAT mantra for decades: a good translation is a carefully thought out piece of writing that applies the translator's specialized knowledge to communicate the content of the original accurately and in the style appropriate for the intended readers. That is true for translations in fields from fashion to nuclear fusion: describe a pleat as a fold, or a plasma as a fluid, and you are sunk. To reinforce his or her field-specific knowledge, a thoughtful translator will always look carefully at the references and illustrations provided with the text as well as consult reliable sources to get the terminology, and style, right. All the finalists in this year's Japanese-English translation contest translated the text reasonably well, but there were major variations in accuracy and writing style.

Translation E17 is an excellent example, written in a clear, appropriate style that communicates the content accurately, for the most part. The first sentence makes a strong beginning and adroitly handles the dread など. The second sentence, with its rather ambiguous "In contrast to these," is weaker, and the choice of "delicate" instead of "fragile" for 脆弱 is unfortunate.

Its second paragraph, describing the storage process, the translator uses the term "quartz glass," although the article by Watanabe et al. cited in the second endnote clearly states that it is "fused silica." That article also clarifies how the に of 石英ガラスに記録した should be translated. In the third paragraph, the translator describes the newer technology as recording information "on the interior of the quartz glass," i.e., in it. In the previous paragraph, however, he states that in the 2009 version, the information is recorded on the medium; have the researchers shifted from recording on the surface to the interior? No: the Watanabe article on the 2009 research clearly states that information was recorded in the fused silica.

The third paragraph begins weakly with "This time" for 今回 but goes on to set the stage nicely for the technical description in the second section, which is readable and accurate, with field-appropriate use of exponential numerical expressions and the abbreviation S/N. The final sentence of the second paragraph in that section does introduce confusion by referring to the "above-mentioned modified region," when the term "region" had not be used previously: The sentence in question states "it is possible to modify the refractive index of microscopic areas." The term (and whether it is singular or plural) should be kept consistent.

The data retrieval process described in the next paragraph was a challenge for all the translators. Translation E17 handled it reasonably well, with "photographed" instead of "imaged" for 撮影, a choice probably guided by intelligent reference to figure 2, but stumbled on アナログ画像については、たとえば、デジタルデータのビットに相当する微小変性領域を用いて点描画として記録することが可能である, as did all the other finalists. "This analog image could be recorded as dots, for example, by utilizing the microscopic modified areas corresponding to bits of digital data" is confusing. The authors are saying that they can provide instructions on how to read the data in the same way they recorded the data: ". . . by utilizing microscopic modified regions just as they were used to record data" The concluding paragraph is also clear and readable, although “semipermanent lifespan” seems less exhilarating than the hundred millions of years the authors promise.

Translation E5, which reads well and is largely accurate, also deftly avoids the など trap in the first sentence. Unfortunately, 和紙 has been translated as “paper,” a technical error. A much more serious error is the use of “fused silica glass crystals” instead of “fused silica.” Glass--even the glass we call crystal--is amorphous, as a little reading would have made clear.

“There is some data, however, such as cultural and historical information” is a clumsy beginning to the next paragraph. Beginning a sentence with “there is” should be always avoided; combining that with “some data” (when some readers will persist in regarding “data” as plural) is doubly awkward.

The next paragraph, about the 2009 research, avoids the in/on question about how data are recorded while describing the advantages of the medium clearly.

Part 2, while rather freely translated, communicates the technology to the lay reader, with the exception of the passage concerning the analog image explaining the data retrieval process, where the translator stumbles over the same sentence as did E17. It is not “on the same minute scale that bits are written” but “in the same way.”

The final paragraph ends eloquently with “could last virtually indefinitely,” which corresponds well to the hopes of the authors.

Translation E13 begins badly, with a very literal, clumsy sentence that includes “and the like” for など. The translator has sloppily omitted a comma in the next sentence (or conflated two types of media: “solid state hard drive”). The final sentence of that paragraph, “Some hold the opinion that it would be best to copy the data to the next new medium in a perpetual cycle of data migration,” is an incorrect rendering of 繰り返せばよい. The sense of the Japanese is that it might be possible to cope by repeatedly copying the data, not that that is an ideal solution.

The translator has not checked the Watanabe article about the 2009 research and states that the information is recorded on fused quartz, while overstating the degree of certainty about its lifespan: “showed [it] had a lifespan of several hundred million years” might be better as “could have a lifespan . . .” The next paragraph discusses “a large amount of bit information.” Instead of that very literal rendering of 多数のビット情報, “large volumes of binary information” as used in E17 would be more appropriate.

Part 2 begins well, but the second paragraph uses “image” as a verb instead of “photograph” for 撮影, although figure 2 clearly shows a camera being used. It goes on to state that the researchers “then apply a high signal-to-noise ratio,” as though that ratio were a handy tool instead of a measure of the quality of the processing, and mentions “low-power photography,” when 低倍率 obviously refers to the microscope. The description of the analog image for explaining the data retrieval process in the next paragraph tripped this translator up badly. Moreover, the concluding sentence states that “fused quartz is expected to be nearly semipermanent,” when it is the data recorded in it, not the medium per se, whose lifespan is the issue.

While parts of the translation are well written, this translator veers in places between being painfully literal and being inaccurate, with insufficient understanding of either the original text or how to present it in English.

Translation E33 is also uneven. The first paragraph begins well but loses a bit of force by omitting the "even once" in the cycle of migrating data in the last sentence. The second paragraph's "weather with heat or humidity" is both an awkward phrase in English ("weather due to" or "weather under" would be more natural) and a rather free translation of 劣化 in this context. The third paragraph states, "We . . . have proven the potential"; "proven" is rather a leap for 示した; "showed" or "demonstrated" would be more appropriate, both as a translation in general and as usage in research reports. The translator has also not consulted the references and learned that the data are stored in, not on, the fused silica. (Perhaps not surprisingly, E33 dropped all endnote numbers after the first one.) In another poor use of "proven," that paragraph ends with, "Our teams have proven that this can be read as digital data," in which the referent for "this" is not clear.

Part 2 begins well, but this translator also stumbles over the paragraph about the analog image. Beginning with "the most effective way" is problematic in the same way as "proven" was above: both inaccurate and an overstatement. The description of the analog images is less confusing than some of the other translators' stabs at it, but still misses the mark.

Translation E37 combines some strengths with a number of errors and stylistic flaws, starting, unfortunately, with the first sentence: why not make it "Some written records" instead "Of the written records . . . , some"? The translator states, in the third paragraph that in the 2009 procedure, information is recorded in fused silica glass, suggesting use of the references, but then uses "fused silica glass" instead of "fused silica" and omits all the superscripts for the endnotes. That paragraph ends with "Furthermore, it is highly heat resistant and durable against sudden changes of moisture"; the Japanese is 温度, not moisture. In the next paragraph, the translator has turned an optical microscope into a digital one. "Basic image processing" is perhaps no different from "simple image processing," but seems an over interpretation of 簡単.

In Part 2, "micro-region" seems a good choice for 微小な領域. "The recorded pattern is imaged" instead of "photographed" suggests a failure to look at the figures. The description of the analog image is as muddled as most of the other translators', with the addition of the wrong tense in "It was possible to record" instead of "It would be possible."

Ken Wagner

The passage for the Tenth JAT Translation Contest, “A Storage Technology for Hundred-million-year Preservation,” presented challenges of both technical and non-technical translation. The introduction’s an evocative description of the history of document preservation resembled non-technical writing, but the passage then quickly morphed into a more nuts-and-bolts technical writing piece. The finalists displayed a variety of approaches to the material – from conservative to daringly interpretive and creative. The top two finalists accurately conveyed the article’s message to the reader in a pleasant manner, with only a few slight exceptions. The other three finalists conveyed most of the message accurately and serviceably.

The English-language references in this text provided almost all of the English terminology required for the translation. The finalists took advantage of this information to varying degrees and somewhat sporadically. Most finalists did considerable rewriting to break away from the Japanese syntax. However, there was one sentence that required extensive rewriting to make complete sense in English, and no one took the large leap to rearrange that sentence (about the analog image). This text featured quite a few large Japanese numbers, and everyone got them right.

Following the individual commentaries, there is a table comparing the translations of some key elements of the text.

I would like to thank everyone who participated in the contest for making the effort to produce such good translations and to congratulate the first and second place finishers Kamil Spychalski and Colin Wilson and the other three finalists Heidi Christian, Natalie-Anne Hall, and Keith Krulak. The finalists have already made great strides in their Japanese studies and displayed an aptitude for translation. I wish them well in whatever career they pursue.

Kamil Spychalski - First Place

Kamil’s translation was highly accurate and the most pleasant to read of the more conservative translations. The reader definitely understood the background and the process after reading the translation. After Colin, Kamil scored highest for “artistic impression,” i.e., my subjective impression when reading the translation without having seen the Japanese text for a couple of months. Kamil demonstrated a grasp of the technical aspects of the material by not trying to use a lot of unnatural coined terms. Kamil used active verbs and provided the necessary padding to achieve genuine English syntax.

Kamil began Introduction Paragraph 1 with a pleasing tone to the English-language reader by using “some [records]” for 記録の中に…ものがある, as did several other finalists. Kamil distinguished *washi* from wood pulp paper, which is not as durable, by calling it Japanese paper. Kamil translated “大容

量、低コストを追加している" literally but cleanly. This phrase is awkward to translate and was dropped from the English version of this series of studies (Reference 2). "After standing the test of time for thousands of years" might be a little colloquial for a technical article, but may be appropriate for this kind of feature article and short communication and was a pleasant turn of phrase. Kamil used "delicate" for 脆弱; "fragile" would probably have been more appropriate. Saying that the life of digital data is "a brief 10 to 100 years" was pithy.

Kamil translated 温度と湿度の管理 as "even with the necessary temperature and moisture control." The authors were probably specifically referring to the heating, ventilation, and air conditioning system that would be needed, a specific storage requirement. Some other finalists translated this as something even farther from the Japanese, but Kamil at least retained the idea of temperature and moisture control. However, Kamil used the term "moisture" instead of "humidity." Humidity is specifically defined as the amount of water in the air whereas moisture is water found in a variety of places (as vapor, within a solid, or condensed on a surface).

"Hardware needed to read the data will become unavailable in the future" is a fluid and natural 意訳 approach to 再現できなくなる. However, the article assumes that the equipment will definitely be unavailable in the future and will have to be recreated somehow. Reference 2 used the term "reconstruction" of hardware, and something closer to the Japanese would be better. Nonetheless, for the prosaic texts found in technical writing, it may be good to used seemingly hackneyed words that the English-language reader expects to hear like "available" and "involved." If an expression is hackneyed, it's definitely English and not translationese. The description of data migration was somewhat unnatural. But this process was completely rewritten for English publication in Reference 2, and the version here is hard to deal with.

Introduction Paragraphs 2 and 3 contained detailed descriptions of the storage technology desired and fused silica, the proposed storage medium. Kamil presented this dense information in a faithful, smooth, and straightforward way that sounded like English. Kamil ended the introduction with a clear translation of the brief summary of the storage method provided, and correctly identified the laboratory involved. Like all of the contestants, Kamil got the Japanese numbers right (banzai!).

Unfortunately, Kamil called 石英ガラス "quartz glass," when three English-language references called it "fused silica." Kamil also said that fused silica has a certain lifespan rather than a "potential lifespan." "Lifespan" was spelled two different ways, which may irk someone paying actual money for a translation.

There is a kind of dissonance between the intangible and tangible in the phrase "in areas such as cultural heritage or historical archives." But Kamil didn't say we need to record cultural heritage as some contestants did. いつの時代にも was translated as "over the course of human history." This is an elegant turn of phrase, but the Japanese refers to the future and something like “at any time in the future” may be more appropriate than mentioning history.

The method section was well fleshed out and pleasant to read overall.　Kamil translated the title (記録と再生の方法) “storage and retrieval method.”　Dictionaries provide these glosses for the two words, although storage and recording may be different things. The cited references use the terms ”record” data and ”read” or ”extract” the recorded data. The description of femtosecond laser and the ultrashort time durations involved was vivid. I would have preferred to have the time spans described with words instead of exponential expressions, but engineers, the intended readers, might like numbers better. Kamil said the refractive index was “modified.” Reference 2 used this term and it seems to appear in the literature. The description was also free of over interpretation that appeared in some of the other translations. For example, Kamil said simply said the method avoids “cracking due to heat” without over embellishing (e.g., cracking due to “thermal shock”). However, the paragraph contained two consecutive sentences with a “by doing something, this happens” structure.　The two sentences together sounded a little translated. And simple is usually better. Kamil said “Figure X indicates” but “Figure X shows” might be better for the graphic depiction (a picture) referred to here this rather than something requiring an inference. Google Scholar gives one million hits for “Figure 1 shows” as opposed to 58,000 for “Figure 1 indicates.”

In Method Paragraph 2, Kamil called the light-modifying device a “spacial light modulator,” the term used by References 2, 4, and 6. This term has many web hits, including images, url names, and examples of similar applications. The term “空間位相変調器” seems to have many glosses. In addition, Reference 6 of the contest passage is sales information for the device, but the authors don’t use the same Japanese term as the sales literature, making this a bit of translation challenge. Thankfully, Kamil simply uses “to photograph” rather than “to image” for 撮影. The “such that” construction, used by Kamil and several other contestants, seems to be reserved for equations and formulas in technical writing for the most part. Editors seemed to change my “such that” to “in such a way that” a lot when I was starting out. It is probably better not to use “this time” for 今回 and Kamil eventually switched to ”in the most recent or experiment.”

Method Paragraph 3 remained close to original while still being very readable. However, this resulted in the pattern of ”image is photographed and read following signal processing.’ Simply following the chronology in English may be better (‘pattern is photographed, subjected to signal processing, and read’). “Signal processing” comes second in the Japanese order as well.

In Method Paragraph 4, Kamil used “dots” for 点描画(!) (rather than pointillism): “this analog image could be recorded as dots,” a great turn of phrase. Reference 2 also uses the simple term “dots.” Adding “way” to “recording … is an effective way to ensure” gives the sentence a pleasant natural sound.

However, 相当する in the description of the method of 'drawing' the analogue image proved to be a stumbling block for all of the finalists and presented an opportunity for liberal editing that none of the finalists took full advantage of. The sentence was アナログ画像については、たとえば、デジタルデータのビットに相当する微小変性領域を用いて点描画として記録することが可能である。Kamil translated this as "This analog image could be recorded as dots, for example, by utilizing the microscopic modified areas <u>corresponding to bits of digital data.</u>" 相当する is often tricky to translate, and "corresponding" is not really used this way in English. In addition to be confusing in general, this rendition almost seems to suggest that the dots already present in the digital data are somehow manipulated to form this graphic image. Rewording the 相当する part of the sentence describes the process clearly to the English-language reader: This analog image could be recorded as dots, for example, by utilizing microscopic modified areas <u>in the same way that they are used to record bits of digital data</u>.

In the pleasantly written final paragraph, "up to 4 layers" is a nice touch. There are no hits on Google for the Japanese description of recording density (平面記録密度), and Kamil used a parallel term 平面記録密度 that accounts for the Japanese, although it has a mere 7 hits on Google. Kamil described the storage material has having a "semipermanent lifespan," a serviceable expression, but not the most eloquent of the contest finalists. This may be a personal preference, but it may be better not to rely on "[results] led us to (conclude, expect, etc.). "[Results] suggest" seems to be a safe bet much of the time.

Kamil is already a fairly well accomplished translator. Except for the 相当する expression, Kamil conveyed the information in this passage with a high degree of fidelity so that the reader understood the intended meaning. The passage was pleasant to read with only a few awkward or stilted phrases. With more practice, Kamil will learn ways around difficult Japanese expressions and find it easier to rewrite awkward English expressions to make them clear and fluid. Congratulations on winning this year's contest.

Colin Wilson - Second Place

Colin pushed it to the limit with a non-literal translation. That's not a bad strategy in the contest situation. Why not go for it? With Colin's translation, the reader almost always knew the authors' intent. To me, Colin's translation was unquestioningly the most enjoyable to read based on the merits of the English syntax and word choice alone. Colin was still very accurate, with only two actual errors that would have misled the reader.

However, things can go somewhat awry if the translator feels the need to reword every line in a technical text. If you rewrite something, it should be rewritten to conform to the conventions of the discipline better than a close translation. Authors of technical articles are thinking of particular equipment that has to be used or specifications that have to be meant, so that rewriting should be tailored to that with the proper terminology and manner of expression.

If not immediately, the translation may need to serve as evidence for an intellectual property lawsuit which would require an accurate rendition of the equipment and processes used. In an English version of this line of study (Reference 2), the structure of the first paragraph of the introduction was changed, but the description of the technology was left intact.

Colin combined many great turns of phrase and deft editing choices to provide the reader with the most readable translation of this year's contest.

The descriptive introduction of the passage allowed Colin to demonstrate his excellent writing skills. Examples include: a very clean opening sentence; editing out the "pursuit" of the "pursuit of high-capacity, low-cost" although slightly changing the meaning; "although it can be argued" for 意見も有る; "we demonstrated the potential of fused silica glass…;" not using parentheses in Japanese fashion (at room temperature); not saying that you record heritage; the phrase "so that it can be read for ages to come;" the use of "[did] successfully" for "was confirmed" (This information has been successfully read back using a low-power microscope and simple image processing). Like this last sentence, the syntax was very clean throughout the introduction.

In the method section, the description of the laser and recording method was smooth and economical, although liberally edited. The recording and retrieval processes are described with short, simple sentences listing the steps in sequential order. Other good translations include: the use of the preferred term "spatial light modulator;" "up to four layers of patterns;" and the use of "virtually indefinitely" to describe the potential lifespan of the storage medium, as pointed out by Ruth McCreery in our discussions.

Examples of free translation that, while not completely wrong, may mislead the reader and might require later clarification: "information" for "records;" "must be protected from temperature and humidity" for "requires temperature and humidity control" (a specific process requiring specific equipment); "the question of whether the hardware necessary to read the information <u>will still be available</u> in the future" for "the question of whether the hardware necessary to read the information <u>can be duplicated</u> in the future" (hardware that is already unavailable must be built from scratch); moisture for humidity; "that can withstand fire and water" rather than "fire- and water-resistant" (a matter of degree on a specific scale?); "extremely pure" for "extremely few impurities;" "information" for "digital data;" : and "burst of energy" for "optical energy" of the laser pulse.

Two things that departed from the meaning of the text: describing fused silica as a crystal and the 相当する passage mentioned above. Describing fused silica as crystal really bothered a chemical engineer who read the translation. It would have been be extremely prudent to read a description of fused silica before finishing this translation. I read a description of it before judging the translation contest. The Wikipedia entry for fused silica, very easily accessible, says that it is amorphous, i.e., non-crystalline. However, it also appears that Colin was making a diligent effort to use active verbs with subjects and objects in English fashion and was just attempting to fill in a blank. However, it would have been safer not to make such a commitment here. A vague term such as "the material" could have been used instead of "crystal" which is blatantly wrong and annoying to the intended reader.

Laudably, Colin edited "corresponding" out of the 相当する sentence and applied some interpretation to capture the meaning, but still didn't capture the full extent of the meaning: "Such images could even be rendered in a sort of pointillism <u>on the same minute scale that bits are written</u>." An interpretation such as the following is probably closer: "Such images could even be rendered in a sort of pointillism by utilizing microscopic modified areas <u>in the same way that they are used to record bits of digital data</u>.

Colin displayed a true talent and might be destined for something greater than run-of-the-mill technical translation. But if Colin continues in technical translation, it would be prudent to confine the rewriting to the conventions of the discipline involved.

Heidi Christian

Heidi unfortunately started off by retaining the Japanese syntax in the very first sentence of the text, which is kind of an affront to the English readers' senses, especially if the readers are working translators. But Heidi later came through with a very solid translation of the technical section. The prose was serviceable with a few awkward spots and several eloquent spots. There were several extremely free translations, as with Colin. However, with the exception of a couple of missteps, the authors' intended meaning was conveyed to the reader. Any relevant comments from Kamil's and Colin's translations apply here.

On the positive side, Heidi's translation featured: a very natural description of data migration compared to other contestants; the use of both words and numbers to describe the laser burst; a clear description of fused silica; a nice description of the recording process; and the use of expressions other than "this time" for 今回.

On the other hand, in Introduction Paragraph 2, Heidi omitted "temperature and humidity" and used "cultural artifacts" for 文化遺産. The Wikipedia definition of artifact is "something made or given shape by man, such as a tool or a work of art, esp an object of archaeological interest".　I was thinking more *Kojiki* than *haniwa*, and the article itself describes the longevity of written materials, rather than implements and works of art or images of them.　Heidi also called the material "fused quartz;" said fused silica had a lifespan of *x* years rather than "potential lifespan;" employed strange usage in "record … <u>bit information</u> … <u>into</u> layers of fused quartz;" added "shock" in "without causing it to crack from thermal shock;" gave a somewhat awkward description of the laser and designation of 0s and 1s; used "to image" for “to photograph” (had a jarring effect when repeated); used the odd expression “the bit density of the surface;” and used the less-than-superlative term “nearly semipermanent” to describe this lofty achievement.

Unfortunately, Heidi made three errors, two of major importance and one of very small importance . Heidi said that the authors “apply [or use] a high signal-to-noise ratio to retrieve the digital data” when the text and common sense say that the data is retrieved at a high signal-to-noise ratio. This phrase describes a state rather than an action. Unfortunately, in the sentence about the analog image sentence in Method Paragraph 4, Heidi said “this would include an explanation, for example, that by altering microscopic areas of the glass that correspond to digital data bits, it is possible to record data as a pointillized image.” Here, the sentence simply means that dots are burned into the silica to draw a picture that illustrates the process. This sentence seemed to confuse everyone, but this rendition was incorrect. Of minor importance, Heidi said “recorded a test pattern like the one in Figure 3 onto a maximum of four layers inside a piece of fused quartz.” This sounds like there are layers of silica inside the piece, rather than layers referring to the arrangement of the dots. Ironically, the target readers would have probably understood the authors intended meaning.

Heidi conveyed a large amount of technical information in an accurate and pleasant manner. Some of the awkwardness could be easily overcome with more practice at editing and rewriting and eventually getting to recognize set patterns in Japanese and English that map to one another. Brilliant smoothing can often be the result of some very simple mechanical rearrangement.

Natalie-Anne Hall

Natalie-Anne produced a very good translation. She did not commit any major errors and her prose was serviceable. Natalie-Anne seems to have done the most research. She added outside information to provide subjects for verbs. Natalie-Anne was the only finalist to have said that the hardware could not be replicated in the future rather than that it would be unavailable in the future. Oddly, Natalie-Anne didn’t include the superscripts for the endnotes. As above, any relevant comments from Kamil’s and Colin’s translations apply here.

On the positive side, Natalie-Anne: used “some” in the opening sentence; distinguished “*washi* paper” from other paper; adroitly handled the potentially awkward “in constant pursuit of higher capacity at a lower cost;” said “become unable to replicate the hardware ” rather than the hardware may be unavailable (the text assumes it’s already unavailable); translated the first sentence about data migration smoothly; clever syntax in Introduction Paragraph 2 (… to allow …); used “multi-bit ,” a term from Reference 4; use proven for 確認; and described the recording and retrieval process chronologically.

Some unnecessary changes or excessively free translations were: the use of "temperature and humidity monitoring" vs "control;" saying "'we' will be unable to replicate [present technology] in the future" when the sense is that our present selves will no longer be around; second sentence of data migration perfectly colloquial, but somehow odd sounding (However, all it takes is for this cycle to be broken and the data is lost.); the use of "weather" for 劣化 in this context; "store cultural heritage;" occasional questionable use of the past perfect tense instead of simple past tense ("have proven in 2009," "in our latest work we have teamed up with"); slightly too many compound adjectives ("heat-induced [fractures]; "refractive-index-modified [areas];" use of "such that" in "[the storage device] was developed such that" in Method Paragraph 2; omission of 今回 in Method Paragraph 2; said an analogue image is "the most effective way" vs "an effective way" to ensure the data can be read in the future; use of "trial" for 試作 (Reference 2 used "experimental system"); and somewhat awkward final sentences despite some editing.

Like everyone else, the method of forming the analogue image led to an error or incomprehensibly confusing English rendition: "These analog images can be recorded as pin-point sketches by modifying a minute area equivalent to one bit of digital data." Although the intended readership of trained engineers would probably be able to puzzle out the meaning, on the face of it, this translation almost sounds like a sketch, the size of a pinpoint, is recorded in one dot.

However, as with the other finalists, Natalie-Anne has already developed considerable skill in technical translation. The bulk of the information was conveyed in pleasant form, and Natalie-Anne showed the potential to improve with practice, with more practice at self-editing and more exposure to common patterns in Japanese technical writing.

Keith Krulak

Keith's translation featured serviceable prose, and a couple of highlights that met or exceeded the equivalent translations by the finalists. However, Keith's translation had a few more minor and serious errors and awkward spots than the other finalists.

On the positive side, Keith: distinguished "Japanese paper;" used "some" in first sentence (although retains Japanese syntax); faithfully translated "control temperature and humidity;" did not follow Japanese parentheses usage; recognized that cultural heritage needs to be in some recordable form ("cultural heritage assets"); used the English-sounding "future generations" (although the authors seem to be talking about a time too long to measure in generations); said "used signal processing to sharpen the altered micro-regions described above" (as opposed to emphasize the image); and used "dot" when referring to 点描画.

Excessively free or misleading translations included the following: translated "over [the span of - 越えて] thousands of years" as "in excess of several thousand years;" gave an awkward, literal translation of "media …that seeks mass storage and low cost;"combined second and third sentences of Introduction Paragraph 1 to create one fairly rambling sentence and omitted 懸念もある in the process; said hardware may not exist in future vs can't be duplicated in future; omitted the 経年 of 経年劣化 and translated "fire- and water-resistance" as "heat and moisture resistance" in Introduction Paragraph 2; translated "highly resistant to chemical change" as "highly chemical resistant;" translated "one 10 trillionth of a second" as "10 trillionths of a second;" used "to image" for "to photograph;" translated "photograph at low magnification" as "low-power magnified imagery;" in Method Paragraph 5, omitted "a maximum of " from "recorded in a maximum of four layers" and omitted "by optimizing recording conditions;" and didn't include the superscripts for the footnotes.

One seemingly good translation that varied from the original Japanese and the other finalists was translating 一つのパルスを 100 本のパルスに変換する as "transforming one light pulse into 100 beams." After all, one pulse comes out of the laser and no more sequential pulsing occurs. However, given the definition of a pulse (a single vibration or short burst of sound, electric current, light, or other wave), it seems 100 pulses of energy arrive at the silica, justifying the more literal translation of "transforming one light pulse into 100 pulses"

Keith made two serious errors with regards to the Japanese. In the first error, in Method Paragraph 2, Keith wrote a statement that is completely true with respect to the article, but does not convey the idea of the sentence: Keith translated 再生は遠い将来でも再現できるような方式を開発した。 "We developed a retrieval method to permit reproduction in the distant future." Keith got tripped up by the topical sentence where "wa" doesn't indicate the subject of the verb. The statement offered here is true, but it deprives the reader of the information that "We developed a retrieval system that can be replicated in the distant future," an important component of the article.

The second error involved the description of the analogue image. Here, Keith chose the wrong verb tense ("it would be possible" instead of "it was possible") and, like most of the other finalists, provided a literal translation of 相当する in アナログ画像については、たとえば、デジタルデータのビットに相当する微小変性領域を用いて点描画として記録することが可能である。This rendered the English confusing to the reader. "It was possible to record this analog image, for instance, as a dot image using micro-alteration of regions corresponding to digital bits."

Keith had a few more awkward turns of phrase and made a few more errors than the other finalists, but he conveying the larger part of the meaning of a genuine technical text, and, as a finalist, he completed a better translation than 32 other contestants. That is evidence of considerable achievement and potential for growth as a translator.

Comparison of Selected Terms and Phrases

Source Text	Colin	Heidi	Kamil	Natalie-Anne	Keith
和紙 Is made from a variety of materials; not made from wood pulp; tougher than wood pulp paper.	paper	paper	Japanese paper	*washi* paper	Japanese paper
大容量、低コストを追加している半導体、ハードディスク、光ディスク	High-volume, low-cost modern data storage media	ever higher-capacity, lower-cost [media]	which pursue high capacity and low cost	mediums, in constant pursuit of higher capacity at a lower cost, are	media for digital data that seeks mass storage and low cost
記録と再生の方法 Ref 2: recorded and extracted data	Writing and Reading	Recording and Retrieval Methods	storage and retrieval methods	Recording and reading data	Methods of Recording and Retrieval
Kyoto University Miura Laboratory (web)	Yes	Yes	Yes	Yes	Yes
石英ガラス Refs 2, 4, 5: fused silica	Pretty close: fused silica glass	No fused quartz	No silica glass	fused silica	fused silica
空間位相変調器 Refs 4 and 6: spatial light modulator	spatial light modulator	phase modulator	spatial light modulator	phase spatial light modulator - some hits google	spatial phase modulator - 万s of hits; used with microscopes
撮影 Ref 2: to photograph	to photograph	to image	to photograph	to photograph	to image
点描画 Ref 2: dots	pointillism	pointillized image	as dots	pin-point sketches	as a dot image
デジタルデータのビットに相当する微小変性領域を用いて点描画として記録することが可能である。 More interpretive version: This analog image could be recorded as dots, for example, by utilizing microscopic modified areas in the same way that they are used to record bits of digital data. Jim Davis' even more liberal version: It is possible to record this analog image as a collection of dots, with each dot being a microscopic region with a refractive index that was modified following the same procedure that was used to record one bit of digital data."	Such images could even be rendered in a sort of pointillism on the same minute scale that bits are written.	This would include an explanation, for example, that by altering microscopic areas of the glass that correspond to digital data bits, it is possible to record data as a pointillized image.	This analog image could be recorded as dots, for example, by utilizing the microscopic modified areas corresponding to bits of digital data.	These analog images can be recorded as pin-point sketches by modifying a minute area equivalent to one bit of digital data.	It was possible to record this analog image, for instance, as a dot image using micro-alteration of regions corresponding to digital bits.
半永久的	last virtually indefinitely	semi-permanent	semi-permanent lifespan	semi-perpetual lifespan "semi-perpetual paving materials" appears on an Australian web site and the spell checker for this doc is set to Australian.	nearly semi-permanent