Newsletter

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IEEE Tokyo Section
Life Members Affinity Group

This issue reports the LMAG-Tokyo General Assembly for 2016, the International Year of Light (IYL) Commemorative Lecture Meeting in December 2015, and the IEEE Milestone technical tour for Life Members.

1. Greetings of 2016

Koichi Inada, Chair, LMAG-Tokyo

Greeted all of LMAG-Tokyo members for 2016. Since the establishment of LMAG in IEEE Tokyo Section, this year will celebrate the full six years. During this period, LMAG-Tokyo has hosted many lectures, and arranged technical tours as well as exchange meetings with the young engineers. And, these events were posted on the LMAG-Tokyo Newsletters.

Last year, we held the 6 times of lecture meetings under the cosponsorship with the IEEE Tokyo Section including the technical tour and lectures at University of Electro-Communications, and the commemorative lecture meetings of the International Year of Light and Light-Based Technologies.

The contents of those meetings had been placed in the newsletter on the Web of IEEE Tokyo Section, which were published three issues last year. These newsletters were printed and mailed to all LMAG-Tokyo members at the end of the year.

Like last year, many lecture meetings will be organized in this year. Technical tour is now planning to visit the JAXA Sagamihara campus.

I would like your support to LMAG-Tokyo activities also this year.

2. 2015 LMAG-Tokyo General Assembly

The general assembly of LMAG-Tokyo was held at the room 66, 6th floor, Kikaishinko-Kaikan, from 14:00 to 14:30 on March 28, 2016. The attendants were 34 in number. After the address by Dr. Inada, Chair, the activity report of 2015 was presented by Prof. Miki, Vice Chair. In 2015, six lecture meetings under the cosponsorship with Section's TPC, a technical tour, an exchange meeting and three issues of newsletters were performed over the year.

Photo 1 General Assembly in 2016

Then, the activity plans for 2015 were proposed by Prof. Takano, which includes more than 4 times of lecture meetings, exchange meetings, a technical tour and newsletter publications.

It was also presented to make opportunities to cooperate with other Section's LMAG in this year.

Then, every agenda has been approved.

3. IYL Commemorative Lecture Meeting --- Past Half a Century and Future of Optical Communication ---

Year 2015 was International Light Year and Light-Based Technologies proposed by UNESCO. In this opportunity, the IYL Commemorative Lecture Meeting was held in Kikaishinko-Kaikan, from 14:30 to 17:00 on Monday, December 7, 2015, which was sponsored by LMAG-Tokyo with the cosponsor IEEE Tokyo Section TPC. At the meeting, three lecturers gave the following lectures about optical fibers, optical devices and optical communication systems each, and it has 73 participants.

Lecture 1. Past 40 Years and Future of Optical Fiber

Dr. Ryozo Yamauchi (Fujikura Ltd), presented on progress of the optical fiber for the past 40 years and future.

Since a proposal of Dr. C. K. Kao, Nobel Prize winner, various fabrication methods of the optical fiber composed primarily of a silica glass. OVD (Outside Vapor Deposition) method and MCVD (Modified Chemical Vapor Deposition) method were the mainstream of its production technology at first in US and Europe. In contrast, in Japan, VAD (Vapor phase Axial Deposition) method was developed by the collaborative research of NTT and three cable makers, which is suitable for a mass production. In 1980s, the low-loss optical fiber with less than 0.2dB/km which removed the harmful impurities hydroxyl group was developed as a mass-production technology, because there are few opportunities to technology, because there are few opportunities to pollute a core by the VAD method.

Multi-mode fiber was used mainly in the 1970s, but SMF (Single Mode Fiber) which is suitable for a

Photo 2 Dr. Ryozo Yamauchi at the lecture

broadband transmission was popularized in 1980s. Because core diameter was thin with approximately 10μm in SMF, low loss connection was difficult due to its highly precise core, but a problem was solved by the development of a fusion splice machine and the highly precise connector which aligned an axis. As a result, the traversing Japan optical fiber transmission line linking from Kagoshima to Hokkaido was completed in 1985. The techniques playing big parts to realize high capacity transmission systems for long distance applications are DWDM (Dense Wavelength Division Multiplex), optical fiber reduced dispersion at low loss wavelength 1.5 μm, and erbium doped fiber amplifier. These techniques are applied in the TPC 5 optical submarine cable system with 100Gbps in each 100 wavelength channels per one fiber.

Furthermore, optical access networks are also using SMF and popularized now.

In present, the optical fiber length made in the world is estimated more than 300,000,000km a year, and its 60% is produced by VAD method. In 2015, the VAD method was recognized as an IEEE Milestone for the technique that contributed to the society for a long term.

After around 2000, a digital coherent technique supported by advanced semiconductor technology was developed as an optical transmission method, and the exact wavelength decentralized control of optical fiber became needless. It is thought that the main demand to optical fiber becomes a low loss, the low nonlinear effect from now on. As a method to enable large capacity transmission over single fiber, the study regarding a multi-core fiber technique and a mode multiplex technique using multi-mode fiber is performed enthusiastically, and 2Pbps transmission over single fiber has been reported.

Now, the optical fiber is used for a fiber sensor, a fiber laser, image transmission, and so on, where analysis techniques and production techniques developed for communication are used.

Lecture 2. Past and Future of Optical Devices for Optical Communications

By the subject of the title, Dr. Koro Kobayashi (Professor Emeritus, Tokyo Institute of Technology) gave his lecture as is following.

When we look back the 50 years since the birth of optical fiber communications from the view point of optical devices, we found that continuous innovation of the function and quality through the hard working with the system people. In this talk, routes of the progress of semiconductor lasers are followed as a typical example of optical devices. Finally, future novel development directions of optical devices are addressed.

Photo 3 Dr. Koro Kobayashi at the lecture

Semiconductor lasers, which appeared as a strong candidate for a light source for optical communications, enabled optical fiber transmission systems with several tens Mbps and several tens km in the mid of 1970's, through success of continuous oscillation at room temperature with AlGaAs/GaAs double heterostructure, overcome of initial rapid degradation, and realization of stable fundamental characteristics by the transverse mode control. After that, InGaAsP/InP 1.3 μm single transverse mode semiconductor lasers have been developed for silica single mode fiber transmission systems with a new low-loss wavelength band at 1.3 μm, followed by development of DFB/DBR 1.55 μm single frequency dynamic single mode semiconductor lasers for the lowest loss band of silica fibers at 1.55 μm, where wavelength dispersion newly appeared. These semiconductor lasers have exclusively contributed to realize high-capacity long-distance transmission systems for trunk lines. From the beginning of 1990's when the performance of the optical transmission systems began to saturate, two breakthrough technologies have been developed. They are direct optical amplification and highly dense wavelength division multiplexing. The former technology gives a solution to compensate optical fiber loss and effectively utilized in under-sea optical cable systems. The latter one gives a solution to expand limit of optical bandwidth of optical fibers by multiplexing and demultiplexing many light signals with a wavelength

different to each other. Signal capacity per single optical fiber as high as 20Tbps in experiments and 1-2Tbps in practical systems have been achieved respectively. Semiconductor lasers integrated with modulator and wavelength tunable semiconductor lasers have been developed for these systems. Wavelength tunable and narrow spectral linewidth semiconductor lasers have been developed for newly developed digital coherent systems for 100Gbps class transmission speed.

Future issues for optical devices will be low power consumption, ultra-parallel multiplexing and more functionalization. The key to solve these issues seems to be in photonic integration techniques.

Lecture 3. Past and Future of Optical Communication Systems

Dr. Tetsuya Miki (Professor Emeritus, University of Electro-Communications) gave his lecture on the subject of the title as is following.

The light-wave technology appeared in the 1970s gave the great impact in the history of transmission systems. The optical communications contributed to the cost reduction of the trunk transmission line and the digitization of the communications in particular.

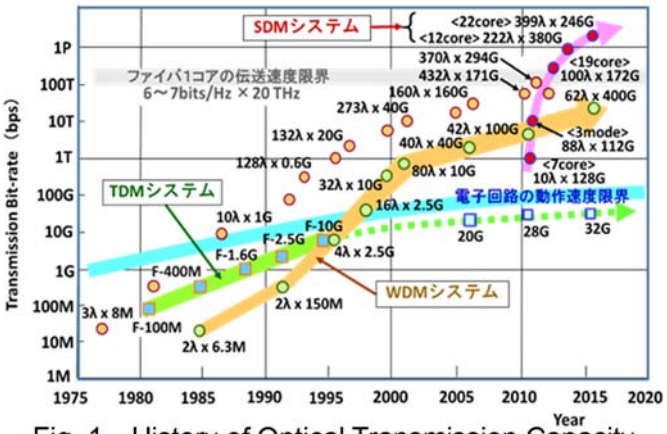

Fig. 1 History of Optical Transmission Capacity

The commercial use of the optical communication was from the early 1980s worldwide, and 45Mbps (uS), 100Mbps (Japan) and 140Mbps (Europe) were introduced at first, however the speedup was carried out as is to 400Mbps, 1.6Gbps, 2.5Gbps and 10Gbps by increasing the number of time division multiplexing (TDM).

The further speedup became difficult due to closing to speed limit of the electronic circuit, and it was pushed to develop wavelength division multiplexing (WDM) using a lot of wavelengths after the mid-1990s. At that time, the emerging optical fiber amplifier had enabled to amplify optical signals of plural different wavelength. The number of wavelength multiplexing and demultiplexing increased rapidly, because the sophisticated plane light circuit technique was developed. The number of wavelength channel is limited by wavelength bandwidth of optical fiber amplifier, which is several hundred channels equivalent to several Tbps transmission capability if each channel is 10Gbps. After that, the technical progress moved to the high efficient modulation/ demodulation techniques like radio communications. The example is QPSK or 16QAM that requires multi-phase and level coherent optical carrier. In this way, around 10Tbps class transmission has been enabled.

The recent research advances in the direction of space division multiplex (SDM) by the multi-core fiber and so on. The example announced recently by NICT and Sumitomo has been demonstrated the capacity of 2.15Pbps in total over a single fiber of 22 cores. However, the transmission capacity seems to be theoretically approaching the limit.

As for optical communication systems in access networks, their technologies had been requested to realize cost at the same level as a phone line. So that, the realization became after entered in 2000. The optical access was groped for from the mid-1980s, but the effective cost reduction technique of PON (Passive Optical Network) was born independently in NTT and BT. Then, its development was accelerated including international standardization from around 1990. As a result, FTTH (Fiber to the Home) service began in 2001 in Japan, and has penetrated to 27 million households now, which means Japan is a world eminent broadband country.

By the way, the mobile communication systems have needed a lot of optical fiber lines for the front halls of mobile base stations due to the cell size reduction corresponding to increasing traffic demand.

From such a technical trend, he pointed that an optical and radio fusion network utilized not only for mobile communications but also for resident disaster prevention, intelligent transport system, IoT and so on should be developed in future, and finished his lecture.

Photo 4 Dr. Tetsuya Miki at the lecture

4. IEEE Milestone tour for Life Members

Koichi Inada

IEEE has given a variety of benefits for Life Members. As the part, the IEEE Life Members Committee (LMC) is organizing IEEE Milestone tours since 2010, and four technical tours took place in past, which were the Panama Canal for 8 days in 2010, the

United Kingdom 10 days in 2011, the Japan 9 days in 2012 and the Canada 10 days in 2013. The fifth tour was taken place to Europe (France, Switzerland and Germany) 12 day in May, 2015. No tour is planned in 2016, but seems to be planned in 2017.

Visibility of this tour is very low in Japan, and participants from Japan is very few. I myself did not know of this tours, but had learned the 2015 tour after I was appointed to the Tokyo Section LMAG Chair in January last year. I signed up for the 2015 tour by checking the participation guidelines at IEEE LMC Web site by myself.

You have no e-mail about this tour from the IEEE LMC. So, you must check the IEEE LMC Web once in a while, if you are interested in this tour. Hence, I will inform about the next tour all of the LMAG-Tokyo members by e-mail, when I get its announcement.

I would like to summarize here the 2015 IEEE Milestone tour that I have participated, wishing to increase future participants from Japan to the tour. The detail including many photos of tours carried out are reported in the IEEE Web (https://www.ieee.org/societies_communities/geo_activities/life_members/tech_tours.html)

This was taken place 12 days from May 6 to May 17, 2015. The tour includes the four visit associated with the IEEE Milestone and other technical tours including sightseeing tours. The participants are 35 people consisting of 16 couples and 3 male singles.

In advance, everyone was asked to agree to inform each other name and e-mail address. All of the participants agreed to inform them, so I learned that participants from Japan are our couple and one male, and also each couple from Canada, Uruguay, South Africa. And all other couples from US, in particular, many from Texas, because the former Chair of Texas LMAG invited eagerly other participants. Among the participants from US, there are two Chinese couples one from Hong Kong and another from Taiwan. All participants were elderly because they were LMAG members, one of wife feet were little weak, and the husband supported her.

The main purpose of the tour is to visit the IEEE Milestone. But, general sightseeing was emphasized than visiting the IEEE Milestone, because the most of participant were with accompany and the tour fee was at his own expense. People who had been participated before seem to look forward to seeing again their friends previously having traveled together.

On the first day of the tour, we had checked in at the designated hotel in Paris and all members gathered in the lobby, and received each badge at 17:45. After we attached his/her badge to own chest and exchanged business card each other, we left for the dinner together.

The tour guide was the British men of about 40 years old. The guide served as our representative, and extended our greetings at the visit places, and expressed our thanks for lunches and dinners on receptions.

On the second day, all day, was for the IEEE Milestone visit, the Eduard Branly Museum (the first radio signal detector) in the center of Paris. The lecturer was the female IEEE Fellow who already retired and was serving as a volunteer. In addition, there attended Branly's great-grandchild of woman and seemed to look forward to meeting our members from many countries.

Photo 5 Lecture of the Edouard Branly who is the French radio father

Buffet lunch with beer and wine was provided by IEEE France Section. And, next visit in the afternoon was the radio monitoring station, Ministry of Posts and Telecommunications, in the suburban Paris. The place around was surrounded by a field of rape blossoms in full bloom. Here, the group photo of all members was taken. It was only this through the tour to have taken a photograph together.

Photo 6 Group photo of all participants

The third day morning was Louvre Museum tour, and a professional guide guided us the museum about 90 minutes. In the afternoon, a paid tour to Palace of Versailles was option, but we stayed in Louvre Museum whole day.

The fourth day was Paris city tour including the 90 minutes Seine River cruise, then was the free action. In the evening of that day, all the members went to the famous restaurant of Paris for a luxury dinner by bus.

Day 5 was headed to Geneva from Paris by bus. In the way, we visited the Hospice de Beaune.

Day 6 was the tour for the IEEE Milestone, CERN (European Organization for Nuclear Research) in Geneva. The CERN is the place that is well-known for the discovery of Hicks particles in 2011. Many visitors seem to come every day from every country in the world. The researchers come from all over the world, but the non-European countries like Japan and US does not seem to fit the member of the council of CERN. In the afternoon, it was Geneva city tour.

Day 7 was a travel to Neuchatel far from Geneva for visit to the heart of the Swiss watch industry. The tour included the IEEE Milestone (the world's first quartz watch) and a watch museum. Lunch was a reception by the IEEE Switzerland Section. In the evening, we were invited to the luxurious dinner also by the IEEE Switzerland Section.

Photo 7 Lunch by the IEEE Switzerland Section

Photo 8 Dinner by the LMAG of IEEE Switzerland Section

Day 8 was moved to Munich from Geneva by bus. On the way, we visited to the World Heritage site Chateau de Chillon in the lakeside of Leman

Day 9 was Munich tour. In the morning, we visited to Alte Pinakothek (Museum of Ancient Art), and in the afternoon, visited to BMW World. The dinner was at the Hofbrauhaus with the members of IEEE Germany Section.

Day 10, in the morning, we visited Munich University, where we got some explanations about IEEE activities of Germany Section. According to the talk, in order to obtain the IEEE Milestone Recognition, not only the Section must prepare the application to the IEEE headquarters, but also a variety of costs have to be borne by applicant. In addition, additional cost is required to obtain a certification nameplate, and after getting IEEE Milestone, the official party for own expense is necessary. By that reasons, the Milestone applications from Germany seem extremely weak. Somehow, the IEEE of US is a competitor for the electrical societies of European countries.

In the afternoon, we visited the Deutsche Science Museum, which is referred to as one of the world's largest.

Photo 9 Lecture on IEEE Germany Section

Day 11 was the final day of the tour. In the morning, we traveled to Oberammergau of the German Alps. The dinner was a farewell one, because of last day. Everyone dressed up and attended. My wife were wearing a kimono brought. We took photos each other before the closing.

After the tour, participants continued the journey by their own schedule.

For reference, the amount of payment to the tourist agents was US $ 3,010 per person. We had to pay personally other costs, for example, airline ticket to Paris and return back to Narita, taxi fare and so on. During the tour, we took lunch and dinner every day, together all. Therefore, it was possible to talk with most of the participants, and we were able to enjoy a pleasant journey. To the next opportunity, I would like to try to invite as many participants from Japan. More information about the tour content, please refer to the following Web:

http://www.inada.haru.gs/201505LMAG1/index.html

5. Future Events

5.1 The LMAG-YPs-Student Branch-JC WIE Meeting

Date and Time: Saturday, April 23, 2016
15:00-17:00, Get-together Party: 17:00-19:00

Place: Conference Hall, 2nd Floor, Raiousha-Blg, Hiyoshi-Campus, Keio University

5.2 Lecture Meeting and Technical Tour at Sagamihara Campus, JAXA

The details will be announced by e-mail.

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