



REPORT
of
The Twenty-Fourth Session of the Council of the
Far East Radionavigation Service (FERNS)

Table of Contents

| | |
|---|----|
| 1. Opening of the Session | 3 |
| 1.1. Introductions | 3 |
| 2. Adoption of the Agenda | 4 |
| 3. Report of the 10th Technical Working Group Meeting | 4 |
| 4. Presentation of reports by each country on the Loran-C/Chayka Programs | 5 |
| 4.1. Operational Status of China Loran-C Chains | 5 |
| 4.2. Operational Status of Korea Loran-C chain | 5 |
| 4.3. Operational status reports from Russia | 6 |
| 4.3.1. Results of operational analysis of the Russian stations in chain B and C | 6 |
| 4.3.2. Briefing on the eLoran Situation in Europe supporting the General Lighthouse Authorities (GLA) | 6 |
| 4.4. On the status of navigation support in the Republic of Kazakhstan | 8 |
| 5. Operating matters for FERNS co-operating chains | 8 |
| 5.1. Scheduled off-air for 2016 | 8 |
| 5.1.1. Scheduled off-air for Loran-C System in China during 2015-2016 (China) | 8 |
| 5.1.2. The Scheduled Off-air of Loran-C Station in 2016 (Korea) | 8 |
| 5.1.3. Scheduled off-air for 2016 (Russia) | 8 |
| 5.2. Other operational matters | 8 |
| 5.2.1. Progress report on the new Russia-Korea chain | 8 |
| 5.2.2. Amendments to the FERNS Agreement | 9 |
| 5.2.3. Amendments of FERNS Operating Guideline | 9 |
| 6. Technical matters for FERNS cooperating chains | 9 |
| 6.1. Research on Loran-C/BD Integrated Navigation Technology | 9 |
| 6.2. Necessity of eLoran future and development plan in FERNS area | 10 |
| 6.3. The Russia-Korea chain | 12 |
| 7. Coordination of other radio navigation services in the Far East | 12 |
| 7.1. China | 12 |

| | | |
|----------|--|----|
| 7.1.1. | Marine RBN-DGNSS System in China | 12 |
| 7.1.2. | Marine BD-CORS System in China | 12 |
| 7.1.3. | Latest Development and Planning of E-Navigation in China | 13 |
| 7.2. | Korea..... | 14 |
| 7.2.1. | Mobile Application for Marine Positioning Information Service..... | 14 |
| 7.3. | Russia..... | 14 |
| 7.3.1. | Chayka/Loran-C Transmit/Receive antennas | 14 |
| 7.3.2. | Aspects of navigation conditions monitoring (NAVIS)..... | 15 |
| 7.3.3. | Experimental investigations of the work of GLONASS/GPS equipment during the period 2014-May 2015 in the Antarctica (Information Analytic Centre) | 15 |
| 7.3.4. | PNT reliability improvement in the Arctic region | 15 |
| 7.3.5. | New AIS applications in Russia (TRANSAS)..... | 16 |
| 7.3.6. | Investigation into the Development of a Unified Receiver Unit (GNSS, Loran/Chaika, Strapdown Inertial Unit) | 16 |
| 7.4. | Strategic Vision & Goals for 2026 (IALA)..... | 17 |
| 8. | Other business | 17 |
| 9. | Date and venue of the 25th Council Session..... | 17 |
| 10. | Report of the 24th session of the FERNS Council..... | 17 |
| 11. | Closing of the session | 18 |
| Annex 1. | List of Participants | 19 |
| Annex 2. | Agenda | 21 |
| Annex 3. | List of Documents | 22 |
| Annex 4. | Draft Amended FERNS Agreement..... | 24 |

1. Opening of the Session

The Twenty-Fourth Session of the Council (FERNS 24) was held in Alfa Hotel in Moscow, Russian Federation, in the period 27-30 October 2015, convened by the Ministry of Industry and Trade. A one day meeting of the Technical Working Group was also conducted on 26th October 2015.

The Chair of the Session, Mr Victor Tsarev, Deputy Director General, Acting Director of the Internavigation Research and Technical Centre, opened the meeting and welcomed all delegates.

Mr Oleg Brianda, Deputy Director of Radioelectronic Industry Department gave the opening address. He welcomed delegates to the 24th Session of the FERNS Council and expressed his confidence that the meeting would have practical results for the safety of navigation. Mr Brianda advised that the Ministry of Industry and Trade of the Russian Federation, and other Federal bodies, were working on new Radionavigation systems and modernisation of existing systems, as well as the integration of Chayka with GLONASS and GPS satellite systems. He foresaw that a mix of satellite and terrestrial systems would bring safety of navigation as well as reductions in costs and energy usage.

He noted that FERNS is the only structure for the improvement of Radionavigation systems in the Far East area, and in closing his address he wishes the meeting participants a successful week.

1.1. Introductions

At the invitation of the Chair, each participant was introduced to the meeting. Representatives of the following Members, Observers and Invited guests participated in the session:

Members:

- The People's Republic of China
- The Republic of Korea
- The Russian Federation

Observers:

- IALA (International Association of Technical Aids to Navigation and Lighthouse Authorities)

Invited guests:

- The Republic of Kazakhstan: The Space Engineering and Technology Institute
- Russian Ministry of Defence
- Russian Academy & Industry:
 - NAVIS DESIGN BUREAU
 - TRANSAS
 - TSNIMash
 - RIRV

Apologies had been received from the following countries:

- Japan

The Director for Coordination of International Cooperation, Administration and Planning Division of the Marine Traffic Department of the Japan Coast Guard had advised that although Japan had seceded from the FERNS Agreement due to the closedown of all Loran-C stations, the Japanese party recognizes the importance of FERNS meetings as exchange of radio navigation system information in the Far East area and therefore the Japanese party would like to continue to attend the meetings as an

Observer. However he regretted to inform that the severe financial constraint in this year does not allow it to send a delegation to the 24th FERNS Council session.

- The United Kingdom and Ireland

The General Lighthouse Authorities of the United Kingdom and Ireland (GLA) sent apologies that they were unable to attend the 24th Session of the FERNS Council in Moscow. The letter of apology contained a briefing on the eLoran situation in Europe and in the United Kingdom. This briefing was later presented to the session.

- The Republic of India

The Directorate General of the Lighthouses and Lightships of the Ministry of Shipping of the Republic of India regretted to advise that due to a certain administrative necessity representatives from India will not attend the 24th FERNS Council session. However the DGLL hoped to participate in the 25th FERNS Council session.

Apologies had been received from:

- Sergey KHOKHLOV, Director of Radioelectronic Industry Department (Russia)
- Victor MALYKHIN, Chief of Division, Radioelectronic Industry Department (Russia)
- Victor MESHKOV, Deputy Director of Department of Foreign Ministry (Russia).

A list of participants is provided at Annex 1.

2. Adoption of the Agenda

The draft agenda was accepted for the conduct of the meeting. The agenda and the list of documents submitted for discussion are given at Annexes 2 and 3 respectively.

3. Report of the 10th Technical Working Group Meeting

The Chairman of the Technical Working Group (TWG), Prof. Dr. Seung-Gi GUG, reported that the Group discussed the following matters at its meeting held on 26th October 2015:

- The minutes of the 10th FERNS TWG
- Recommendation on Amendment of FERNS Agreement
- Final draft revised FERNS Agreement (October 2015)
- Amended FERNS Operating Guidelines (30th October 2015)

The TWG meeting had reviewed the proposed amendments to the FERNS Agreement, noting the footnote proposed for the first page concerning the secession of Japan from the agreement, as had already been notified via diplomatic channels.

The proposed amendments were accepted by the FERNS Council. The draft amended Agreement is at Annex 4.

A draft recommendation from the FERNS Council to China, Korea, and Russia to convey the draft amended Agreement was reviewed and agreed.

The meeting then examined changes to the FERNS Operating Guideline, developed by the TWG, and agreed that the draft new Guideline should enter into effect on 30 October 2015.

The Chair proposed acceptance of the report of the TWG, and there being no objections, the report was accepted.

4. Presentation of reports by each country on the Loran-C/Chayka Programs

4.1. Operational Status of China Loran-C Chains

China advised as follows (CS24-4-1)

Operational Status: During the period from August 2014 to July 2015, the Loran-C system in China kept normal operation, with the signal availability of its chains meeting specified requirements.

System Management: Three terms of technical training courses for technical staff were organized, including one for electromechanical staff and two for navigational staff. The training greatly improved the capability of the technical staff in the aspect of handling equipment failures. It is planned that relevant training courses will be continued next year.

Equipment Management: Importance was always given to management of equipment. From the end of June to the beginning of August this year, a general overhaul of antennae of transmitting stations of GRI8390 and GRI7430 chains was conducted.

Off-air Arrangement: The present quarterly maintenance mechanism will be continued in 2015-2016. A 96-hour off-air period will be arranged each quarter for maintenance of equipment.

In response to a question from the Chair, China advised that its Loran-C antennas are usually in mountainous areas and maintenance of these antennas is usually carried out every two to three years, to counteract lightning strike damage.

Korea asked about staff numbers at China's Loran-C stations and was informed that 20-30 technical persons were engaged at each of the six stations.

4.2. Operational Status of Korea Loran-C chain

Korea advised as follows (CS24-4-2)

During the period from August 2014 to July 2015, the operation status of the Korea Chain (GRI 9930), consisting of Pohang station (M), Kwangju station (W), Gesashi station (X) and Ussuriisk station (Z), was as follows, and the status includes the scheduled off-air time.

Pohang Station (M): As the Master station of the Korea chain, this station showed 99.80% availability on annual average due to the maintenance of transmitter and antenna for 880 minutes, the failure of power source equipment for 150 minutes and the maintenance of antenna lights for 40 minutes.

Kwangju Station (W): As a secondary station of the Korea chain, this station showed 94.11% availability on annual average due to the maintenance of transmitter and antenna for 1,201 minutes, the safety diagnosis of antenna for 400 minutes and the failure of transmitting equipment for 1,622 minutes.

Gesashi Station (X): As a secondary station of the Korea chain, this station showed 99.65% availability on annual average due to the failure of transmitting equipment for 385 minutes. This station ceased operation from February 1, 2015.

Ussuriisk Station (Z): As a secondary station of the Korea chain, this station showed 89.30% availability on annual average due to the maintenance of transmitter and antenna for 52,089 minutes and the failure of transmitting equipment for 2,489 minutes.

Korea noted its wish, in order to improve the availability of Korea chain, that it is necessary to minimize the off-air period of Ussurisk Station and to build a communications network between Korea and Russia.

4.3. Operational status reports from Russia

4.3.1. Results of operational analysis of the Russian stations in chain B and C

Russia advised as follows (CS24-4-3-1)

During the period from October 2014 to October 2015 there was no unscheduled off-air for stations Petropavlovsk-Kamchatsky, Ussuriisk, Alexander-Sakhalinsky and Okhotsk.

The availability of the Russian stations in chain B was 0.9999. In accordance with the FERNS chains practice, availability (D) was determined by the formula

$D = 1 - UUT / \text{The period covered by the usability}$

where UUT = Unusable time .

The time for the maintenance of each station is not taken into account in the calculation of their availability.

4.3.2. Briefing on the eLoran Situation in Europe supporting the General Lighthouse Authorities (GLA)

The General Lighthouse Authorities of the United Kingdom and Ireland (GLA) provided the following written briefing to the meeting. The briefing was prepared by Mr George Shaw, Research & Radionavigation, GLA, and dated 11th August 2015 (CS24-4-3-2):

Introduction: *This Briefing is provided by the General Lighthouse Authorities of the United Kingdom and Ireland (GLA) to Internavigation RTC to explain the current status of eLoran in the UK and Europe. The eLoran situation in Europe is critical and its future will be determined by 31st December 2015. There is a high likelihood that eLoran in Europe could cease from that date. The GLA have committed all available resources over the remainder of 2015 to activities that aim to preserve the option for eLoran in Europe. Consequently, the GLA have sent apologies for absence at the 24th Session of FERNS Council in Moscow from 26th to 30th October 2015.*

Decisions by France and Norway: *The Government of France has formally advised the GLA of its decision to terminate Loran signal transmissions from the two French transmitter stations (Lessay and Soustons) on 1st January 2016 and to close the Control Centre at Brest. In addition, France has advised that the Loran infrastructure at the two transmitter stations will be dismantled during 2016. The Government of Norway has formally advised the UK government of its decision to terminate transmissions from the four Norwegian transmitter stations on 1st January 2016. The Danish Maritime Authority (DMA) has advised GLA that, in line with the French decision and the consequential termination of funding from France, the Loran transmissions from the Ejde station on the Faroe Islands will be terminated on 1st January 2016.*

Effect of the Decisions by France and Norway: *The French and Norwegian decisions, if unchanged, would mean that from the end of 2015, seven of the nine existing transmitters in the North West European Loran system would cease operations, along with the Control Centre at Brest (CCB). This would leave only two Loran transmitters capable of operations, those at Anthorn in the UK and Sylt in Germany. However, with the closure of CCB, no UTC time source will be available at either Anthorn or Sylt, meaning that the transmitters cannot be synchronised with each other or with UTC.*

Even if steps were taken to provide UTC timing to Anthorn and Sylt, the operation of these two remaining transmitters would provide only a precise Timing capability for some areas of Europe. No Positioning or Navigation capability would be possible.

GLA Activities in Europe: *The GLA are urgently seeking wider support for the North West European Loran system. The GLA consider that there is only one viable route to funding for the European eLoran system, that being through private industry investment in the commercial operation of eLoran. In particular, this would focus on the provision of Precise Timing services for applications such as future generations of mobile telecommunications, power distribution via ‘smart grids’ and real-time financial transactions. Hence the GLA is urgently continuing to engage with a wide range of stakeholders in Europe, including the European Commission, DG MOVE, DG GROW and the European Parliament. In the way that eChayka is complementary to GLONASS, eLoran in Europe would be complementary to the European Galileo satellite navigation system in providing fully resilient Position, Navigation and Timing (PNT). Hence the positions of the European authorities are very influential for eLoran in Europe. The complementary nature of eLoran also requires a better understanding by European agencies such as the GNSS Supervisory Authority (GSA), the European Space Agency (ESA) and the European Satellite Services*

Provider (ESSP). There is no agreed policy in Europe to provide a backup to GNSS generally or to Galileo specifically, and although a European Radio Navigation Plan (ERNP) has been partially developed it has never been formally released. The GLA are continuing their efforts to inform and advise all European stakeholders in Resilient PNT.

US Situation: *The US Government is currently seriously considering the option of eLoran to be implemented urgently as a backup to GPS, principally for Precise Timing. A recent US Congressional hearing weighed evidence on the costs and benefits of eLoran, and queried the cause of delays encountered by the US Department of Transport and the US Coast Guard (USCG). There is significant support for eLoran in the US Congress and a meeting of the US PNT Advisory Board (EXCOM) on 3rd September 2015 may accelerate the implementation and operation of eLoran in the US under a Public Private Initiative (PPI). <http://rntfnd.org/2015/07/29/you-have-put-this-nation-at-serious-risk/>*

Any imminent move to progress eLoran in the US would be influential on the future of eLoran in Europe. It is possible that venture capitalists in the US may also be interested in wider investment opportunities in eLoran commercial operations in Europe.

Future of eLoran in the UK: *The UK Government recognises the vulnerability of GNSS and the benefits that eLoran could bring. However, there is no feasible option for a UK-only eLoran solution that provides sufficient coverage of the surrounding UK waters to protect the navigational safety of international shipping. In the event that a commercial operation for eLoran in Europe cannot be secured, then eLoran in the UK cannot provide the required maritime backup for GNSS. Without eLoran continuing in Europe, the UK may be forced to abandon eLoran as a maritime backup for Position and Navigation.*

GLA Resource Commitment: *As the future of maritime eLoran in the UK is very uncertain, the UK Department for Transport (DfT) has requested GLA to consider an alternative plan for future maritime Resilient PNT, with alternative technology options such as ships’ radars, shore-based radio beacon infrastructure and the possible use of existing maritime DGPS beacons for ranging (so called ‘R-Mode’). Hence GLA eLoran resources are fully committed from August to December 2015 to urgent activities. On the one hand, GLA are supporting eLoran in Europe by:*

- (i) Planning an approach to full eLoran in Europe, its architecture and equipment upgrade, encompassing existing UK eLoran, for possible commercial operation;*
- (ii) Contributing to the business case for commercial eLoran operation in Europe and seeking private investment for eLoran in Europe.*

On the other hand, GLA are considering alternatives for maritime resilient PNT by:

- (iii) Planning for the possible termination of maritime eLoran in the UK, including the cessation of Differential Loran Initial Operational Capability (IOC);*
- (iv) Considering a plan for maritime resilient PNT for shipping around the UK and Ireland using alternative technology options other than eLoran.*

The Chair indicated that the Council could consider this information in future discussions.

4.4. On the status of navigation support in the Republic of Kazakhstan

Mr Denis Eremin, Head of Laboratory, the Space Technology Institute of the Republic of Kazakhstan made a presentation (CS24-4-4) on Navigation Technology Developments on behalf of the Ministry of Investment and development of the Republic of Kazakhstan, Aerospace Committee, National Centre for space research and technologies, Institute of space engineering and technologies.

After covering the organisational structure, he described the development of a high precision satellite navigation system using 52 DGNSS stations with GLONASS, GPS and Galileo. The DGNSS stations are designed to operate down to -50C and are remotely monitored and controlled. Receivers are also under development, as is a state geodetic support system with 300 receiver stations.

The Chair thanked Kazakhstan for its presentation and expressed his regret that Belarus, which is also cooperating in the development of radio-navigation systems was not able to attend.

5. Operating matters for FERNS co-operating chains

5.1. Scheduled off-air for 2016

5.1.1. Scheduled off-air for Loran-C System in China during 2015-2016 (China)

China provided its planned off-air schedule (CS24-5-1-1) showing 96 hours per quarter.

In response to a question from the Chair, China confirmed that this time was fully utilised for maintenance.

5.1.2. The Scheduled Off-air of Loran-C Station in 2016 (Korea)

Korea provided its planned off-air schedule (CS24-5-1-2).

5.1.3. Scheduled off-air for 2016 (Russia)

Russia provided its planned off-air schedule (CS24-5-1-3).

5.2. Other operational matters

5.2.1. Progress report on the new Russia-Korea chain

Both Korea and Russia spoke about the need for this new chain and upon the work and discussions that had preceded the present meeting (CS24-5-2-1-1 and CS24-6-3).

Korea explained the administrative and contractual events that had led to the delays in implementing its e-Loran plans and thanked Russia and the Council for its understanding.

The Chair noted the previous discussions on this topic and hoped for positive developments at this meeting.

In response to a question from Russia, Korea confirmed that its international tender process had not yielded a result, and it would proceed with R&D within Korea from 2016 with a view to purchase of all systems for installation inside Korea from within Korea, both transmitting and receiving equipment.

The Chair requested Korea and Russia to consider if any future changes should be made to the FERNs Agreement or to the Operating Guideline as a result of the new chain.

5.2.2. Amendments to the FERNs Agreement

(CS24-3-2 and CS24-3-3)

The Technical Working Group, had prepared a draft revision of the FERNs Agreement for consideration by Council. Following advice provided by China, the draft carried a footnote on the title page to indicate the withdrawal of Japan from the Agreement. Refer Annex 4.

The Council reviewed this draft and approved it.

The Council noted that Korea, as the succeeding hosting Party, will take the necessary action to seek acceptance by all parties with a view to the revised agreement entering into force 60 days after acceptance by all parties.

The chairman of the Council recalled that the discussions on amendment of the Agreement had been in process for a rather long time and felt that all Council members were pleased that the changes to the Agreement are now approaching finalisation.

5.2.3. Amendments of FERNs Operating Guidelines

China, Korea, and Russia agreed the need for revision of the FERNs Operating Guidelines to correctly represent the present situation.

During the TWG meeting, a draft revision proposed by Russia, China and Korea had been taken as the working text and amended as needed via input from the other Parties, and then checked against the draft amendments discussed during the previous TWG meeting. This draft final version was presented to the Council by the TWG Chair.

The Council reviewed the draft proposed by the TWG (Seventh edition dated 30th October 2015) and expressed its acceptance. Refer to CS24-3-4.

6. Technical matters for FERNs cooperating chains

6.1. Research on Loran-C/BD Integrated Navigation Technology

Mr Wang Wei, of the Xi'an Research Institute of Navigation Technology, China, described research on Loran-C/BD integrated navigation technology using Loran-C and BeiDou satellite positioning. (CS24-6-1-1 and CS24-6-1-2)

Using both simulation techniques and field tests, the results suggest that an integrated positioning system using Loran-C and BeiDou satellite will offer the following advantages.

- Greatly improve Loran-C coverage and positioning accuracy

- Overcome and reduce Loran-C positioning blind area and low precision in some regions
- Overcome the shortcoming of BD1 active positioning
- Overcome the shortcoming of insufficient number of satellites to position caused by terrain blocking or electronic interference.

6.2. Necessity of eLoran future and development plan in FERNs area

Korea described its analysis of the global Loran-Chaika situation and Korea's three possible implementation plans. Korea also described its views on the necessity of an eLoran future development plan in the FERNs area (CS24-6-2).

eLoran Situation in Europe

The eLoran situation in Europe is critical and its future will be determined by 31st December 2015. The GLA have committed all available resources over the remainder of 2015 to activities that aim to preserve the option for eLoran in Europe.

eLoran Situation in US

Termination of US Loran-C signals

In accordance with the 2010 DHS Appropriations Act, the U.S. Coast Guard terminated the transmission of all U.S. LORAN-C signals on 08 Feb 2010.

"Loran-C is a federally-provided radionavigation system for civil marine use in U.S. coastal areas. The Nation no longer needs this system because the federally-supported civilian Global Positioning System (GPS) has replaced it with superior capabilities. As a result, Loran-C, including recent limited technological enhancements, serves only the remaining small group of long-time users. It no longer serves any governmental function and it is not capable as a backup for GPS."

Howard Coble Coast Guard and Maritime Transportation Act of 2014

President Obama signed this act into law on December 18, 2014.

Sec. 221. E-LORAN

This section prohibits the Secretary of Homeland Security from dismantling or disposing of any former LORAN system infrastructure for at least one year from the date of enactment of the Act or until the date the Secretary notifies the Committee that such infrastructure is not needed for a positioning, navigation, and timing system to provide redundant capability in the event GPS signals are disrupted, whichever is later. It also authorizes the Secretary to enter into cooperative agreements with public and private entities for the development of a redundant system to GPS, including an enhanced LORAN system.

National Positioning, Navigation, and Timing Resilience and Security Act of 2015

Rep. John Garamendi introduced this bill (H.R. 1678) on March 26, 2015. The bill proposes that, "The Secretary of Defence, in consultation with the Commandant of the Coast Guard and the Secretary of Transportation, shall provide for the establishment, sustainment, and operation of a reliable land-based positioning, navigation, and timing system to provide a complement to and backup for GPS to ensure the availability of uncorrupted or non-degraded positioning, navigation, and timing signals for military and civilian users if GPS signals are corrupted, degraded, unreliable, or otherwise unavailable."

eLoran Situation in Republic of Korea

Korea has considered three possible plans for eLoran coverage of Korea:-

- 1) Implementation Plan of eLoran System (2013)
 - 5 eLoran transmitting stations(3 new stations, 2 improved stations)
 - Installing the systems (2014-2016)
 - Initial Operational Capability (2016 - 2017)
 - Full Operational Capability (2018 -)
- 2) Modification for Implementation Plan of eLoran System (2014)
 - 3 eLoran transmitting stations (1 new station, 2 improved stations)
 - Installing the systems (2014-2016)
 - Test Operational Capability (2017) *
 - Normal Operational Capability (2018)

* After the test operation of the modified Korea eLoran system, Korean Government will consider additional stations for the FOC (Full Operational Capability)
- 3) Sweeping Changes for Implementation Plan of eLoran System (2015)
 - Default in the engagement for international purchasing contract
 - Sweeping Changes from international purchasing to eLoran R&D project
 - Planning for eLoran R&D Project (2015)
 - Undertaking eLoran R&D Project (2016)

Necessity of eLoran Future and Development Plan in FERNS Area

Korea wishes to proceed with four steps for development.

- 1) Securing a Resilient Positioning, Navigation and Timing in FERNS Area
 - Refer to result of simulations on the three cases.
- 2) Technology Development for our own systems within FERNS
 - Standardization of eLoran/eChayka
- 3) Technical Cooperation within FERNS
 - Strengthening technical Cooperation
- 4) Necessity of eLoran Future and Development Plan in FERNS Area
 - Creating a Collective Future and Development Plan among Member States to secure the Resilient PNT system in FERNS Area

After discussion, it was agreed that the development of eLoran-eChayka in the FERNS area would need further work in the area of technical standards to ensure harmonisation of broadcast signals. There was discussion of creation of a possible dedicated group to help progress this work towards the necessary documents. In this regard IALA expressed its support for this process and would wish to assist.

The Chair then reminded the meeting of the communication received from the United Kingdom and Ireland which contained mention of possible private industry involvement in the operation of eLoran in Europe. The Chair suggested that this approach could be considered in the FERNS area.

Korea answered a number of technical questions including on synchronisation, transmitter power, accuracy of positioning, and signal quality control.

During the discussion Chair proposed to conduct consultations on the object of bilateral regional cooperation for the period between the FERNS Council sessions among the involved Ministries of the

Parties – Ministry on Transport of the People’s Republic of China, Ministry of Oceans and Fisheries of the Republic of Korea, Ministry of Industry and Trade of the Russian Federation and within Intergovernmental Commissions. Over the course of the FERNS Council session such consultations had been carried out. Russian delegation will continue the work on the proposals of regional cooperation and will inform the Council about the results on the next 25th session.

Delegations hold the discussion and agreed to consider the matters of the standardization of the requirements for the operation of FERNS chains.

Chair proposed to start preparations for the India, UK and the Republic of Kazakhstan participation as the observers in the work of the FERNS according to the procedure of FERNS Agreement.

6.3. The Russia-Korea chain

This matter is reported under clause 5.2.1 above.

7. Coordination of other radio navigation services in the Far East

7.1. China

7.1.1. Marine RBN-DGNSS System in China

China presented news of its research and trials of Marine Radio Beacon-Differential GNSS in China. (CS24-7-1-1).

China noted that at the 94th meeting of the IMO MSC in November 2014, the Chinese government made a commitment regarding the service performance, management requirements on operation and maintenance of BDS, as well as the policy for application of BDS at sea, which illustrated the responsibility and attitude of the Chinese government. MSC94 approved the Navigation Safety Circular of the BeiDou system, which means the system has been formally included in the World-wide Radio Navigation System and obtained its international legal status in maritime operations.

On the basis of the current RBN-DGPS system, China MSA built two RBN-DGNSS stations on a trial basis to broadcast differential BDS and GPS information in synchronization on the carrier frequency of marine RBN system. The RBN-DGNSS stations use the same carrier frequency and Reference Station Identity Code with the original RBN-DGPS system, and broadcast information using MSK modulation mode at a transmitting power of 200W, without any negative influence on the RBN-DGPS users.

Both the onshore static test and maritime dynamic test show that the RBN-DGNSS system (DBDS+DGPS) produces no negative effect on current RBN-DGPS users and provides better positioning accuracy and reliability than RBN-DGPS system. Two RBN-DGNSS stations in Beitang (Tianjin) and Dajishan (Shanghai) have been operating for more than one year on a trial basis, and have kept stable operation.

China stated that starting from 2015, China MSA initiates a plan to technically upgrade the 22 marine RBN-DGPS stations by stages, with the aim of broadcasting DBDS and DGPS information simultaneously and providing reliable, stable and high-accuracy positioning service free of charge to ships.

China provided answers to questions on accuracy and the format of the differential corrections.

7.1.2. Marine BD-CORS System in China

The BeiDou Continuous Operating Reference Station System (BD-CORS) was presented by China (CS24-7-1-2).

China described its work to construct experimental BD-CORS systems in major waters, including the Bohai Bay and the estuary of the Yangtze River, which improves the positioning accuracy to centimetre level within its coverage. The system at the estuary of the Yangtze River, a high-accuracy positioning system was developed to provide positioning and standing pile service for offshore mobile platforms. By utilizing the centimeter level positioning information provided by BD-CORS in real time, the system can display the current attitude and position of the platform in real time, which will greatly improve the efficiency of marine operations. The system at Bohai Bay will be used for hydrographic surveying.

Upon completion, the BD-CORS system that is composed of about 30 reference stations will be capable of providing more reliable, stable and high-accuracy positioning service for marine users, and greatly contribute to the hydrographic surveying operation and navigational capability of vessels.

In response to questions from the Chair, China advised that the software and the equipment is developed in China, it integrates various GNSS signals, and the operating range is about 50 to 60 km.

7.1.3. Latest Development and Planning of E-Navigation in China

The latest development and planning of E-Navigation in China was presented by China (SC24-7-1-3).

China described its latest developments and the future plans for e-Navigation. It will follow the IMO overarching architecture of IMO, with ship systems, communications links, and the common shore-based system architecture (CSSA), noting the importance of shore services delivered by Maritime Services Portfolio (MSP), and the need for electronic display on board.

China MSA has laid down an E-Navigation Plan and a Development strategy according the characteristics of China's shipping industry and the needs of users. A series of research and study have been conducted in joint efforts with manufacturers and research institutes.

China also mentioned the work by IALA on PNT and the possibilities of R-Mode use of MF radio beacons. It also indicated the importance of the IALA VDES VHF data communications system now under development. According to the technical framework being developed at IALA, a prototype VDES has been produced. Data modulation – demodulation, adjacent channel interference and transmission quality were verified and analysed through simulation, analysis and on-site testing. Trials of AIS range finding mode are being conducted.

Based on the CSSA, a maritime service platform is being developed. The platform collects and aggregates data from vessel monitoring systems such as AIS, VTS, LRIT, CCTV, IALA-NET and data from navigation support systems like AtoN basic data. China also explained that research and study have been carried out on AIS satellites.

In the coming two years, the priority of E-Navigation progress in China is on research and further development. :

- (I) Continue to carry out AIS data uplink and downlink test analyse based on satellite application, and carry out confirmatory test on VDES satellite communication, the VDES data satellite transmission channel will be tested when the condition is feasible.
- (II) Test the MSP service within the Navigation and AtoN Comprehensive Application Platform and achieve MSP information exchange between ship and shore by the application of means of communication such as VDES and BeiDou satellites.

- (III) Collect and aggregate port, pilotage and meteorological data by putting into use S100 XML data exchange technology to provide navigators with application services to aid voyage planning and routeing

Future progress and evolution will be driven by user needs while at the same time taking into account international and national guidelines, policies, standards and proposals. China is favourably disposed to cooperation with other countries and share best practices and experience to further promote the evolution of E-Navigation.

In response to a question from the Chair, China advised that its plans for AIS satellite technology will be implemented within approximately two years.

7.2. Korea

7.2.1. Mobile Application for Marine Positioning Information Service

(C24-7-2-1 and CS24-7-2-2)

Professor Gug advised that the Ministry of Oceans and Fisheries (MOF) has developed a maritime positioning information service and mobile application ‘HAEROAD’ for smart phone users, and started the service from November 1st 2014. HAEROAD was designed for the following purposes:

- a. to provide the positioning and meteorological information for the user, especially small-vessel users and those who enjoy marine leisure without using navigation devices or Electronic Navigational Chart (ENC); and
- b. to send SMS (users’ position information) for rescue operation in an emergency at sea.

HAEROAD is a combination of the words ‘the ocean’ in Chinese character and ‘the road’ in English, which means guiding a safe way on the ocean.

HAEROAD can be downloaded in Google Play Store free of charge. The App hits about 26,000 downloads as of September 2015 and boasts more than 1,000 access records in a day. The App actually served as a big help in rescue operation and a case in point is the rescue of two fishermen in a drifting rubber boat. The Korea Coast Guard could rescue them thanks to SOS SMS service of HAEROAD in April 2015.

As the use of HAEROAD increases, MOF plans to update HAEROAD for iPhone users in 2016. MOF will continue to advance HAEROAD not only for better marine information provision service but also for more efficient emergency rescue operation.

Professor Gug then played a video clip which described the system, and answered a number of questions. IALA and the Chair both conveyed their congratulations on the development of the system.

7.3. Russia

7.3.1. Chayka/Loran-C Transmit/Receive antennas

Russia provided a presentation (C24-7-3-1) of the various Chayka/Loran-C/Receive antennas with a description of their main technical characteristics and advantages.

Those antennas are designed by the Joint Stock Co. Internavigation Research & Technical Centre of Advanced Navigation Technologies and are used in terrestrial mobile objects for various applications such as meteorological facilities, antennas for TV/radio broadcasting centres, antennas for repeater stations or antennas for navigation stations.

The antennas are now in production.

7.3.2. Aspects of navigation conditions monitoring (NAVIS)

Mr Sergey SILIN, Chief of Division of International Cooperation of NAVIS DESIGN BUREAU. Made a presentation (CS24-7-3-2) on integrity monitoring of GNSS signals and the development of specialised equipment for this purpose.

He noted the existing global monitoring systems such as SBAS and SDCM and then described the ENCM equipment recently developed. This equipment contains a precision navigation receiver GLONASS/GPS (survey grade) and a signal spectrum analyser.

In response to questions, Mr Silin advised that the equipment is at prototype stage, that it is suitable as an “add-on” to existing monitoring equipment such as aviation RAIMS. He advised that it could be applied to aviation and other transportation and navigation systems.

7.3.3. Experimental investigations of the work of GLONASS/GPS equipment during the period 2014-May 2015 in the Antarctica (Information Analytic Centre)

Mr Aleksey Bermishev, Expert from TSNIIMash made a presentation on trials of GLONASS/GPS equipment during voyages from St Petersburg to Antarctica by the vessels “Academic Fedorov” and “PNT IAC” (CS24-7-3-3).

A large number of different models of receivers, by a variety of manufacturers was tested.

In summary:-

- Testing of presented national and foreign NUE samples were made in different work modes - GLONASS, GPS, GLONASS+GPS and also in differential navigation mode
- Large volumes of data were collected for the preparation of pilot project “Project on practice of high-precision technologies based on processing GLONASS/GPS measurements in the high ranges using modern methods of satellite measurements processing ”
- Collected data would allow to analyse the work of navigational receivers, that were used in the experiment, in the conditions of vessels manoeuvring in ports and their entrances, in situations of movement in difficult ice conditions, and in the global water aquatory in different ranges, during the vessel land-ice stand in the area of Russian Antarctic stations.

7.3.4. PNT reliability improvement in the Arctic region

The Joint Stock Company Internavigation Research & Technical Centre of Advanced Navigation Technologies made a presentation to the meeting on the improvement of PNT in the Arctic (CS24-7-3-4).

The meeting was advised that on the 19th of February, 2013, the President of the Russian Federation approved a strategy for the development of the Arctic zone of the Russian Federation for the period up to 2020. The Arctic region is of strategic importance for Russia's national interests. The development of the Arctic region is directly related to long-term objectives of the state. The main aims of the "Strategy for the development of the Arctic zone of the Russian Federation and the national security for the period up to 2020" are:

- the expansion of the resource base,
- conservation and provision of the environment protection,
- the modernization and development of infrastructure of the Arctic transport system, including the Northern Sea Route,

- the formation of joint information space,
- the development of coordinate-time support and others.

One of the key and indispensable instruments for the implementation of identified priority directions of development of the Russian Arctic zone is a coordinate-time provision.

Extreme climatic conditions, huge and poorly studied area, large remoteness from infrastructure, the high cost of the work, low stability of ecological systems to anthropogenic influences are all factors that produce high requirements on the PNT reliability and accuracy in the Arctic zone.

A slide presented desirable “Chayka” work areas, which could connect the radionavigation field in the western part of the Arctic with the radionavigation field in the Far East. To ensure such a field it is necessary to install at least 7 radionavigation stations. Within “Chayka” system work areas a positioning accuracy of 150 - 600 m can be realised.

If differential working mode were used, the accuracy of position determination can improve to 50-75 m. The implementation of differential mode positioning accuracy is comparable to the accuracy of GNSS and will not exceed 5 -10 m in local areas.

Integrated GNSS-Chayka equipment was described, as well as high accuracy receivers for use in hydrocarbon deposit exploitation.

The Council noted the need to provide the additional Loran-C/Chayka coverage in the Northern Sea Route area.

The Council noted the actuality and the need of the development of radionavigation systems such as eLoran/eChayka in the Arctic region, increment of its work area in the region by putting into operation new automatic radionavigation stations that will provide an independent GNSS back-up for the achievement of reliable PNT for all the Route from Asia to Europe through the Arctic region.

The Council also has expressed its hope for mutually beneficial international cooperation.

7.3.5. New AIS applications in Russia (TRANSAS)

Dr Yuri Bazarov of AC Kronshtadt Technology presented information on work on AIS technology by his and other organisations in Russia (CS24-7-3-5).

He recalled the work of IALA in developing AIS and then described the different types of AIS station. He then described the four directions of AIS technology being developed:-

- Trials of AIS receivers in space
- Trials of Man-Overboard AIS transmitter
- Mobile navigation system – Tablet FZ-M1
- Transmission of GNSS corrections via VHF AIS Base Station

He concluded by stating that Russia is continuously to widen applications of AIS technology in different marine devices in alignment with IMO policy.

In response to questions, Dr Bazarov replied that he envisaged four to five AIS receiver satellites, that at present data processing is done after receipt of the stored satellite data by the earth station, and that the latency of data was typically 25 minutes for a North-travelling satellite receiving a signal from a ship in mid-Atlantic.

7.3.6. Investigation into the Development of a Unified Receiver Unit (GNSS, Loran/Chayka, Strapdown Inertial Unit)

The Joint Stock Company Internavigation Research & Technical Centre of Advanced Navigation Technologies made a presentation to the meeting on the development of a unified receiver unit which integrates GNSS, Loran/Chayka, and inertial. The development was done by the Internavigation RTC in cooperation with the Far East affiliated structure of the Russian Research Institute of Physical and Radion Technical Measurements (VNIIFTRI) commencing in 2014.

Details of trials of the receiver were described, and results presented.

The Council noted the need of the creation of integrated receiver equipment on the base of mentioned radionavigation systems for the increment of the probability of availability of navigation provision for the users.

7.4. Strategic Vision & Goals for 2026 (IALA)

Mr Michael Card, Deputy Secretary General of IALA, made a presentation describing the Strategic Vision for IALA to the year 2026, the structure of its technical Committees, the work of the World Wide Academy, and its plans for its guidance documents. He also described progress towards a change of IALA to an International Government Organisation, following the Resolution of the IALA General Assembly in 2014.

8. Other business

The Chair reminded the Council of the procedure for acceptance of Observers into FERNS Council meetings, and noted the receipt of communications from Japan and India, each of which had indicated its desire to participate in the work of FERNS as Observer.

He mentioned that communication had also been received from Kazakhstan.

The Chair also reminded the meeting that other countries could apply to be accepted as Observers, and information should be forwarded to the United Kingdom.

Chair proposed to start preparations for the India, UK and the Republic of Kazakhstan participation as the observers in the work of the FERNS according to the procedure of FERNS Agreement.

IALA expressed its satisfaction with these initiatives.

9. Date and venue of the 25th Council Session

Korea, as the hosting party of the 25th Session of the FERNS Council, proposes to hold the 25th session of the FERNS Council in October 2016 in the Republic of Korea.

Date: Oct. 2016

Venue: Korea

For convenience of the participants, the date and venue for the next session will be informed to all members for confirmation no later than 30th June, 2016.

10. Report of the 24th session of the FERNS Council

The Council reviewed the draft report of the 24th session and approved it. The final report is given in Document CS 24/10/1.

11. Closing of the session

The Council expressed its great appreciation to the Russian Federation, in particular to the Ministry of Industry and Trade of the Russian Federation, International Research and Technical Centre for the excellent arrangements made for the meeting, the hospitality that had been shown to all participants and the very interesting visits that were undertaken.

The Chairman extended his appreciation to all the delegates for the hard work, mutual understanding and co-operation that had contributed to the success of FERNS in general and to the 24th Session of the Council in particular.

12.

Annex 1. List of Participants

| Member Countries | | | |
|---------------------------------------|---|-------------------------------|---|
| The Russian Federation | The Ministry of Industry and Trade | SERGEI KHOKHLOV | Director of Radioelectronic Industry Department – Head of delegation |
| | | OLEG BRIANDA | Deputy Director of Radioelectronic Industry Department – Deputy Head of delegation |
| | | VICTOR TSAREV | Deputy Director General - Acting Director, The Internavigation Research and Technical Centre (IRTC) - Deputy Head of delegation |
| | | VICTOR MALYKHIN | Chief of Division, Radioelectronic Industry Department |
| | | VALERY KUVAEV | Expert of Division, Radioelectronic Industry Department |
| | | VASILY REDKOZUBOV | Deputy Director General, The Internavigation Research and Technical Centre (IRTC) |
| | | ANATOLY KUZIN | Chief of Division of the Associated Device Building Corporation |
| | The Ministry of Defense | ALEKSANDR SLEPTSOV | |
| The Foreign Ministry | VICTOR MESHKOV | Deputy Director of Department | |
| The People's Republic of China | The Maritime Safety Administration | ZHENG HEPING | Deputy Director General |
| | | ZENG HUI | Director, Department of AtoN, Hydrography and Radio Communication |
| | | WANG RUI | Senior Engineer |
| | | WU SHENGZHENG | Senior Engineer |
| | | MA MIN | Senior Engineer |
| | Xi'AN Research Institute of Navigation Technology | WANG WEI | Professor |
| Korea | Ministry of Oceans and Fisheries | LEE JONG-CHEOL | Deputy Director, Aids to Navigation Division |
| | Korean Maritime and Ocean University | GUG SEUNG-GI | Professor |

| Technical Working Group | | |
|--------------------------------|--------------------------------------|---|
| Republic of Korea | Korean Maritime and Ocean University | GUG Seung-Gi Head of Department of Coast Guard Studies |

| Observers | | | |
|---------------------------------------|--------------------------------|---|--|
| IALA | IALA | MICHAEL CARD | Deputy Secretary-General |
| | | CHRISTINE PHILIP | Finance & Administrative Manager |
| The Republic of Kazakhstan | The Space Technology Institute | NURLAN SATEROV | Deputy Director |
| | | DENIS EREMIN | Head of Laboratory |
| Invited guest | | | |
| Ministry of Defense | | ALEKSANDR GRITSOV VLADIMIR BELOV STANISLAV KRYLOV | |
| Russian Academy & Industry | NAVIS DESIGN BUREAU | SERGEY SILIN | Chief of Division of International Cooperation |
| | TRANSAS | YURI BAZAROV | Expert |
| | TSNIIMash | ALEKSEY BERMISHEV | Expert |
| | RIRV | VLADIMIR PEREKRESTOV NIKOLAY GORDIENKO | Head Adviser Adviser |

Annex 2. Agenda

THE 24th SESSION OF THE COUNCIL
OF THE FAR EAST RADIONAVIGATION SERVICE (FERNS)

1. Opening of the session
2. Adoption of the agenda
3. Report of the 10th Technical Working Group meeting
4. Presentation of reports by each country on the Loran-C/Chayka programme
5. Operational matters for FERNS cooperating chains
 - 5.1 Schedules off-air for 2016
 - 5.2 Other operational matters
6. Technical matters for FERNS cooperating chains
7. Coordination of other radio navigation services in the Far East
8. Other business
9. Date and venue of the 25th session
10. Report of the 24th session of the FERNS council
11. Closing of the session

Annex 3. List of Documents

| Doc. No. | Description | Contributor |
|---------------|--|-------------------|
| CS24/3 | Report of the Technical Working Group session 10 | |
| 1 | TWG10-07-01 10th minutes of FERNs TWG | |
| 2 | Recommendation on Amendment of FERNs Agreement | |
| 3 | Final Draft Revised FERNs AGREEMENT (October 2015) | |
| 4 | Amended FERNs Operating Guidelines (30th October 2015) | |
| CS24/4 | Presentation of reports by each country on the Loran-C/Chayka programs | |
| 1 | Operational Status of China Loran-C Chains in 2015 | China |
| 2 | Operational Status of Korea Loran-C chain | Korea |
| 3-1 | Results of operational analysis of the Russian stations in chains B and C | Russia |
| 3-2 | Briefing on the eLoran Situation in Europe supporting the General Lighthouse Authorities (GLA) | Russia |
| 4 | On the status of navigational support in the Republic of Kazakhstan | Kazakhstan |
| CS24/5 | Operating matters for FERNs cooperating chains | |
| 5.1 | Scheduled off-air for 2016 | |
| 1 | Scheduled Off-air for Loran-C System in China During 2015-2016 | China |
| 2 | The Scheduled Off-air of Loran-C Station in 2016 | Korea |
| 3 | Scheduled off-air for 2016 | Russia |
| 5.2 | Other operational matters | |
| 1-1 | Progress report on the new Russia-Korea chain | Korea |
| 1-2 | Amendment of FERNs Operating Guideline(KOR) | Korea |
| 2-1 | FERNs Agreement | Russia |
| 2-2 | Amendments to the FERNs Operating Guidelines (A&B) | Russia |
| CS24/6 | Technical matters for FERNs cooperating chains | |
| 1 | Research on Loran-C_BD Integrated Navigation Technology | China |
| 2 | Necessity of eLoran future and development plan in FERNs area | Korea |
| 3 | The Russia-Korea chain | Russia |
| CS24/7 | Coordination of other radionavigation services in the Far East | |
| 1-1 | Marine RBN-DGNSS System in China | China |

| | | | |
|----------------|--|--|---------------|
| | 1-2 | Marine BD-CORS System in China | China |
| | 1-3 | Latest Development and Planning of E-Navigation in China | China |
| | 2-1-1 | Mobile Application for Marine Positioning Information Service, Korea | Korea |
| | 2-1-2 | Mobile Application for Marine Positioning Information Service, Korea | Korea |
| | 2-2 | HAEROAD movie clip | Korea |
| | 3-1 | Chayka/Loran-C Transmit/Receive antennas | Russia |
| | 3-2 | Aspects of navigation conditions monitoring (NAVIS) | Russia |
| | 3-3 | Experimental investigations of the work of GLONASS/GPS equipment during the period 2014 - May 2015 in the Antarctica (Information Analytic Center) | Russia |
| | 3-4 | PNT reliability improvement in the Arctic region | Russia |
| | 3-5 | New AIS applications in Russia (TRANSAS) | Russia |
| | 3-6 | Investigation into the Development of a Unified Receiver Unit (GNSS, Loran/Chaika, Strapdown Inertial Unit) | Russia |
| | 4 | Strategic Vision & Goals for 2026 | IALA |
| CS24/8 | Other business | | |
| | 1 | | China |
| | 2 | | Korea |
| | 3 | | Russia |
| CS24/9 | Date and venue of the 25th FERNS Council session | | |
| | 1 | Date and Venue of 25th session | Korea |
| CS24/10 | Session report | | |
| | | Final Report on the 24 th session of the Council of the Far East Radionavigation Service (FERNS) | |

Annex 4. Draft Amended FERNS Agreement

AGREEMENT
BY
THE GOVERNMENTS OF
THE PEOPLE'S REPUBLIC OF CHINA,
JAPAN,
THE REPUBLIC OF KOREA
AND
THE RUSSIAN FEDERATION
ON
AN INTERNATIONAL PROGRAM
FOR THE ESTABLISHMENT
OF A JOINT RADIONAVIGATION SERVICE
IN FAR EASTERN WATERS
USING LORAN-C AND CHAYKA STATIONS

Revision entering into force 0000.00.00 (the date of entry
into force)*

* In accordance with Paragraph 1 of ARTICLE 9 "WITHDRAWAL" of the Agreement, Japan closed the four of its Loran-C ground stations and officially withdrew from the Agreement from February 1, 2015. The Agreement is amended hence forth and approved by the 24th session of FERNS Council (October 2015, Moscow). Hereinafter, "Parties" to the Agreement as amended refers to the governments of the People's Republic of China, the Republic of Korea and the Russian Federation.

The Governments of the People's Republic of China, Japan, the Republic of Korea and the Russian Federation (hereinafter referred to as "the Parties"):

AIMING at the development of international cooperation in radionavigation;

NOTING the importance of the international joint use of "Loran-C" and "Chayka" systems;

DESIRING to strengthen and broaden the international cooperation in ensuring safe navigation in the interests of users from all States;

TAKING into account the efforts of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) on the establishment of safety of navigation services in the oceans of the world and the efforts of the United States Coast Guard as technical advisors to this Agreements;

CONVINCED that joint efforts of all countries in the world on increasing radionavigation coverage is important for ensuring the safe and efficient navigation;

RECOGNIZING the rights of all users to use radionavigation services on a non-discriminatory basis;

HAVE AGREED as follows:

1. ARTICLE 1 Definitions

For the purposes of this Agreement:

"Program" means the activities to be carried out by the Parties to provide, operate and coordinate radionavigation services of the region, in particular the service of "Loran-C", "Chayka" and follow-up developing radionavigation system.

"Cooperating Chain" means any national or international "Loran-C", "Chayka" or combined Loran-C/Chayka chain which contributes to the radionavigation service provided in accordance with the terms of this Agreement.

2. ARTICLE 2 General Obligations

The Parties shall, subject to the national laws and regulations in force, implement the provisions of this Agreement to:

1. assure the long term and coordinated operation of the "Loran-C" and "Chayka" radionavigation systems;
2. provide to the world community, without discrimination, radionavigation services for ensuring the safe and efficient navigation;
3. assist in fulfilling the tasks of IALA concerning the safety of navigation of shipping; and
4. define the means by which the Parties will coordinate the management of radionavigation services of the region, in particular cooperating chains, and work together with States which are not Parties to this Agreement and relevant international organizations while operating and maintaining the radionavigation services.

3. ARTICLE 3 General description of a cooperating chain

1. A cooperating chain shall include:

National "Loran-C" and/or "Chayka" ground stations; monitors; control stations; and, means of communication and management.

2. The ground stations shall be united functionally (master and secondaries), operate on one common center frequency of 100kHz and have a common structure of radionavigation signals. Secondary stations shall radiate in a fixed time in respect to signals of the master station.
3. The configuration of a cooperating chain shall be defined by the Council, as specified in Article 6 and 7 of this Agreement, and will be annexed to this Agreement, by means of a codicil.
4. Methods of synchronization of stations included in a cooperating chain shall be defined by the Council.
5. Composition and functional purpose of stations of a cooperating chain may be changed in accordance with the decisions of the Council.

4. ARTICLE 4 Responsibilities of the Parties when operating a cooperating chain

1. Each Party will be responsible for implementing the program and for providing for the operation of its ground stations of "Loran-C", "Chayka", combined Loran-C/Chayka chains and follow-up developing radionavigation system on a long term basis.
2. The contribution of each Party shall consist of at least one ground station in a cooperating chain.
3. The contributions of the Parties to the composition of the radionavigation service will consist of ground stations in the following localities:

The People's Republic of China:

Raoping, Hexian, Chongzuo, Helong, Rongcheng, and Xuancheng

Japan:

Tokachibuto, Minamitori Shima, Gesashi, and Nii Jima

The Republic of Korea:

Pohang and Kwangju

The Russian Federation:

Petropavlovsk-Kamchatskiy, Alexandrovsk-Sakhalinskiy, Okhotsk, and Ussuriysk

4. Each Party may determine additional contributions to the composition of the cooperating chains.
5. In the case of any change in the contribution by a Party, the Party concerned shall notify the hosting Party of the Council prescribed in Article 8 of its intention to make the change at least six months prior to the effective date of the change.
6. Each Party shall be responsible for the maintenance of its ground stations and for ensuring that they meet the technical characteristics and operating procedures adopted by the Council.
7. The Parties shall ensure administrative, operational and technical coordination among themselves and with other States which operate radionavigation chains.
8. The Parties shall supply information for users concerning chain operation, including system quality.
9. The Parties shall exchange such information as is necessary

for carrying out their obligations under this Agreement.

5. ARTICLE 5 Financial matters

Each Party shall fund its own expenses for activities pertinent to this Agreement.

6. ARTICLE 6 Structure

1. In accordance with this Agreement, a Council will be established.
2. The Council shall be composed of one representative of each Party. The representative may be accompanied by deputies and experts at meetings of the Council. In addition, the Council may request the presence of representatives of IALA and, if necessary, other organizations prescribed in Article 7, paragraph 2(e) and States which are not Parties to this Agreement and may closely confer with them.
3. A Government which is not a signatory may address to the Council a request to participate in the work of the Council as an Observer. A letter of request shall be addressed by the candidate to the hosting Party at least four months before the next Council meeting as defined in article 8. The hosting Party shall address the request to the other Parties at least two months before the next Council meeting. If the Parties unanimously agree to the request, the new candidate becomes an Observer and is entitled to participate in the Council meetings and other related meetings, but without right to vote. The hosting Party will then inform the applicant.
4. The Council shall adopt its own rules of procedures.
5. The Council shall meet as necessary, but in any case not less than once a year.
6. The Council may establish subsidiary bodies for the implementation of the Program.
7. Decisions of the Council shall be made by the unanimous vote.
8. The working language of the Council shall be English

7. ARTICLE 7 Functions of the Council

1. The Council shall implement the policies set out in this

Agreement and coordinate the activities of the Parties.

2. The functions of the Council shall include, inter alia:
 - (a) making recommendations to the relevant Parties;
 - (b) formulating the necessary technical, administrative and operational plans for the implementation of this Agreement;
 - (c) considering any proposed amendment to this Agreement;
 - (d) the preparation, consideration and adoption of technical specifications for ground stations and the adoption of technical and operational documentation relating to the operation of the cooperating chains;
 - (e) ensuring interaction and cooperation with the International Maritime Organization (IMO), the International Civil Aviation Organization (ICAO), the International Telecommunication Union (ITU), IALA and such other organizations as may be necessary for the purpose of coordinating technical matters;
 - (f) the establishment of mechanisms for the exchange of appropriate technical and operational information;
 - (g) deciding on matters concerning relations with States which are not Parties to this agreement;
 - (h) coordination of tests and research work necessary for the operation of radionavigation services of the region, in particular cooperating chains.

8. ARTICLE 8 Hosting Party of the Council

1. The responsibility of hosting each Council meeting shall be rotated among the Parties. The hosting Party shall be responsible for all administrative support of the meeting. Such responsibilities will include, inter alia:
 - (a) administrative support of any Council business between meetings;
 - (b) organization of the meeting, including Agenda preparation;
 - (c) chairing the meeting; and
 - (d) presentation of a summary report.

These responsibilities will pass to the succeeding hosting Party one day following the conclusion of any given meeting.

2. The hosting Party shall inform promptly all Parties to this Agreement of the date of receipt of notifications of acceptance of amendments, the date of entry into force of amendments and of the receipt of other notifications.
3. Travel and subsistence expenses shall be the responsibility of the attendees.

9. ARTICLE 9 Withdrawal

1. A Party may withdraw from this Agreement, by giving written notice to the hosting Party to that effect. Such withdrawal shall take effect one year after the date of receipt of such notification by the hosting Party, or at such a later date as may be specified in the notification.
2. A Party intending to withdraw from this Agreement shall endeavor to ensure continuity of coverage and, in this respect, shall consult with the other Parties to determine adjustments in their respective responsibilities.

10. ARTICLE 10 Amendments

1. Amendments to this Agreement may be proposed by any Party to this Agreement.
2. Any proposed amendment shall be made available to all Council members at least ninety days before it shall be considered. The Council shall consider the proposed amendment at the next meeting after the ninety day period and shall make a recommendation to the Parties concerning any such proposed amendment.
3. An amendment shall enter into force sixty days after the hosting Party has received notification of acceptance from all Parties.

11. ARTICLE 11 Entry into force

1. This Agreement shall be open for signature by the Governments of the People's Republic of China, Japan, the Republic of Korea and the Russian Federation.
2. This Agreement shall enter into force on the day on which all of these four Parties have signed this Agreement.
3. This Agreement shall remain in force for a period of five years and shall be extended automatically for successive

periods of five years unless all the Parties agree to terminate this Agreement.

IN THE WITNESS WHEREOF, the undersigned, being duly authorized by their Governments, have signed this Agreement :

Done at Moscow on December 22, 2000.

For the Government of the People's Republic of china

For the Government of Japan

For the Government of the Republic of Korea

For the Government of the Russian Federation