Master Plan and Roadmap 2017

(1)The Science Council of Japan’s Master Plan 2017, February 2017

The Science Council of Japan’s Master Plan 2017, which will serve as a base for the Roadmap, emphasized scientific judgment in its formulation, and states that, “in addition to including large research projects that are required by each scientific field, it is aimed at giving certain policies for the ways that Japan’s large research projects should be, and is not directly involved in things such as budget allocation for resource allocation organizations.” Meanwhile, although the Working Group’s Roadmap does not guarantee budget measures, as a document that should be sufficiently considered for promotion of related policies, from the perspective of clarifying priority for promotion of the Large Projects, it summarizes the Working Group’s evaluation results, main outstanding points, and tasks and points to keep in mind in large scientific research projects of the Master Plan 2017 that have been recognized as particularly having certain priority.

…

In February 2017, the Science Council of Japan formulated the Master Plan 2017, which resulted from observing science as a whole, creating systems, and making **182 projects in the 24 fields** that are necessary for each scientific field (including integrated fields that are related to two or more fields). The Master Plan 2017 placed importance on involvement by scientist communities, a method of soliciting proposals from committees in each field was adopted, and from among the proposed projects the important large research projects that should be implemented particularly promptly were formulated. The Master Plan 2017 was created from 166 new large scientific research projects (Classification I) and 16 large scientific research projects that are currently being implemented (Classification II).　Of these, **Classification I includes the 28 important large research projects stated above.**

For the roadmap 2017

… the 65 projects that are subject to hearings for important large research projects in the master plan 2017 … decided on a total of 20 projects (**19 from important large research projects** and **1 from projects other than important large research projects**) to be subject to hearings for the roadmap2017

Master Plan 2017より

分野	計画番号	学術領域番号	大型施設計画、大規模研究計画の別	重点大型研究計画(◎)・ヒアリング対象(○)	「マスタープラン2014」の重点大型研究計画	計画名称	計画の概要	学術的な意義	社会的価値	計画期間	所要経費(億円)	主な実施機関と実行組織
物理学	62	23-2	施設	○		高輝度大型ハドロン衝突型加速器(HL-LHC)による素粒子実験 (Particle physics with the High-Luminosity Large Hadron Collider (HL-LHC)) HL-LHC	欧州合同原子核研究機関の大型ハドロン衝突型加速器LHCを2024年頃に高輝度化(HL-LHC)し、LHCよりも広い質量領域で新粒子を探索する。また、ヒッグス粒子などの詳細測定から新物理の兆候を探る。	素粒子物理学上の大問題である、力の統一、階層性問題、暗黒物質などに対する実験からの知見を得られる可能性が高い。また、ヒッグス場の相転移の理解を深めることで、初期宇宙研究を大きく前進させる。	学問的・知的価値については、ヒッグス粒子発見以上の教科書の大幅な変更が必要となる結果が期待される。経済的・産業的価値については強磁場電磁石開発や、超伝導電送など、スピンオフによる効果が大きい。	H28-H30:開発および試作品製造 H31-H35:建設 H36-H37:検出器搬入設置調整 H38-H47:本格運用	総額104 加速器:ビーム分離用電磁石33、建設分担25 検出器:シリコン24、ミューオントリガー14、トリガー用計算機など8	LHC加速器に対する寄与は高エネルギー加速器研究機構が中心となる。ATLAS実験は国際共同実験で、国内組織は高エネルギー加速器研究機構や東京大学など17の研究機関からなる。
	63	23-2	施設	◎	○	J-PARC実験施設の高度化による物質の起源の解明 (Elucidation of the origin of matter with an upgrade of the J-PARC experimental facility)	J-PARC大強度陽子ビームを最大限に活用し研究成果創出の為、ハドロン実験施設の拡張整備を行いミュオン電子転換実験やハドロン実験を行う。更に物質生命科学実験施設にミュオンg-2/EDM実験を実現する。	世界最大級の大強度二次粒子ビーム(主にミュオンおよびK中間子)により、宇宙開闢初期に創成された素粒子とその後に創られたハドロン・原子核・原子が織りなす階層構造すなわち物質の起源を解明することができる。	宇宙と物質の起源の探求は、人類共通の知的資産を産み、社会の多分野発展の重要な基盤・原動力となる。世界最先端の基礎科学を日本で発展させて国際社会の信頼と尊敬を得、科学水準と社会の活力の向上に資する。	ミュオン実験(COMETとg μ-2/μ EDM):H29-H38建設と運転 ハドロン施設拡張:H30-H39建設と運転	総額304 ハドロン施設拡張178、測定器整備34、ミュオン電子転換過程探索実験46、ミュオン異常磁気能率/電気双極子能率測定実験46、運転経費15.2/年	KEK素粒子原子核研究所でJ-PARCハドロン実験施設を建設運用しているグループを中心に機構内外(理化学研究所仁科加速器センター、大阪大学核物理研究センター)と連携して実施する。
	64	23-2	施設			国際リニアコライダー計画 (International Linear Collider Project)	エネルギーフロンティアの電子・陽電子衝突型加速器。衝突エネルギーは250-500GeV、将来は1000GeV領域への拡張可能性。国際的な合意と参加に基づき日本に建設し、国際共同実験を行う。	ヒッグス粒子、トップクォーク等の高精度測定、ダークマター粒子や超対称性粒子等の新粒子・新現象探索を通し、真空構造、力の大統一、新対称性を探求し、新物理学の方向を定め、宇宙進化を解明する。	ILC国内誘致は、広く社会的、産業的な波及効果をもたらす。ILCを中核とした国際都市は、次世代リーダーや加速器産業イノベーションの世界的な発信地となり、国際科学イノベーション拠点形成のモデルケース。	H30頃:政府意思決定、その後本準備4年+建設9年。 H42頃:稼働開始、約10年間の稼働後、アップグレードを計画。	総額8309 加速器建設8309、労働力2290万人・時間(他、準備経費、研究所運営費、人員、測定器建設費要) 経費不定性:25%	ILC研究所(仮称)の発足までは、KEK、CERN等が連携して立ち上げLCCが中核となる国際準備組織。KEKはLCCと連携し中心的役割。測定器・物理研究は国内外研究所・大学。
	65	23-2	施設	◎	○	大型先端検出器による核子崩壊・ニュートリノ振動実験 (Nucleon Decay and Neutrino Oscillation Experiment with a Large Advanced Detector)	スーパーカミオカンデに代わる超大型水チェレンコフ検出器ハイパーカミオカンデを建設し、J-PARC加速器ニュートリノと組み合わせて世界最先端のニュートリノ研究を行う。また最高感度での核子崩壊探索を行う。	ニュートリノにおけるCP対称性(粒子・反粒子対称性)の破れを測定し、ニュートリノに満ちた宇宙の進化論に対する理解を深める。さらに核子崩壊探索と合わせ、素粒子物理学の標準理論を超える物理の確立を目指す。	素粒子の大統一理論や宇宙進化の謎に迫ることにより、人類の知的好奇心に訴える問題に挑戦する。また我が国が主導してきたニュートリノ研究の飛躍的発展により、国民に基礎科学の夢とロマンを与えたい。	H30-H57: ハイパーカミオカンデ地質調査及び建設、運転 H38-H47: J-PARC1.3MW大強度運転	総額1547(日本分担1393) ハイパーカミオカンデ:建設費675(551)、運転経費400/20年 J-PARC:運転経費400/10年(他、加速器増強費等72(42))	東京大学宇宙線研究所と高エネルギー加速器研究機構素粒子原子核研究所が中心となり推進し、国内外の大学・研究機関の参加も予定。
	66	23-3	施設			広帯域X線高感度撮像分光衛星 FORCE (A broadband X-ray imaging spectroscopy with high-angular resolution: the FORCE mission)	存在が期待されながら未検出の「ミッシングブラックホール」探査を目的とした小型衛星計画。ブラックホールからのX線を高感度で捉えるため、1-80 keVの広帯域を10秒角にせまる角度分解能で撮像分光する。	現在の宇宙を構成する天体の形成史を解明することは、宇宙物理学の最重要課題の一つである。ミッシングブラックホールの存在を捉え、その形成過程・進化を明らかにすることで、その答えを得ることができる。	人工衛星を用いたX線宇宙観測は、その最初期から日本が発展に寄与し成果をあげてきた。人類の知的共有財産の創出に貢献し続けることで、若者の夢を掻き立て、技術発展をもたらし、国民に自信をもたらす。	H29-H31:観測機器開発 H32-H33:衛星提案・審査 H34-H38:衛星製作・試験 H38:打上げ・運用開始	総額135 打上げ費用50、衛星バス開発・試験55、X線検出器15、運用含む諸経費15(海外機関負担分は含まず)	広帯域X線高感度撮像分光衛星 FORCE ワーキンググループ(宮崎大学、京都大学、東京大学等の大学機関と ISAS と NASA/GSFC の日米の宇宙機関から構成)

Roardmap 2017 by MEXT , July 28,2017

From among the projects that respectively obtained certain levels of evaluation for items 1) and 2) above, matters that require more detailed confirmation under the Direction for Improvements, such as the system for taking responsibility for project promotion, the state of decisions for organizational intentions, the legitimacy of budget and manpower planning, the state of preparations for research and facilities, and international superiority that results from implementation at an early stage, were evaluated more rigorously and carefully considered from a comprehensive viewpoint that includes things such as the characteristics of the field, and then **7 projects** that could be recognized as having particularly high levels of urgency and strategic value in order to start and materialize projects were carefully selected and a decision was made to state them in the Roadmap. We expect that these 7 projects will be realized.

Roadmap2017 : Points for the evaluation :

1 agreement within the scientists community,

2 implementing institute of the project,

3 system for joint use, and

4 legitimacy of the project.

In addition, as viewpoints for clarifying the priority for promotion of the Large Projects, it set the following three things:

5 urgency ,

6 strategic value, and

7 understanding/ support of the general public and society,

In addition, based on these things, parties related to science and technology, such as **the Science Council of Japan(SCJ)**, which formulates the Master Plan, **the Council for Science and Technology (MEXT)**, which formulates the Roadmap, and **related government agencies**, conducted even deeper and broader promotion of mutual information exchanges and collaboration about the ways of promoting the Large Projects, the Master Plan, and the Roadmap, and we expect that, through clear and effective functioning of the cycle of drafting, implementing, evaluating, and improving, stratified and strategic promotion of the Large Projects can be aimed for in Japan, and that this will result in expansion of an appealing research environment that is open to the world, and in strengthening of Japan's knowledge base.

4) Depending on the scientific field, in circumstances in which international cooperation is essential due to the increased scale of research, the Roadmap contributes to promotion of international cooperation, as something that indicates the outlook about promotion of the Large Projects in Japan.

In Europe and the United States, promotion plans (roadmaps) for the Large Projects are being formulated and promoted by things such as Europe's "European Strategy Forum on Research Infrastructure (ESFRI)," the UK's "Research Council," and the United States' "Department of Energy (DOE)." For the Large Projects, such Roadmaps are being utilized to promote the clarification of the division of roles with overseas research institutes and researchers and the building of a cooperation/collaboration system. From now on it will be necessary to further utilize the Roadmaps and promote the Large Projects with even greater awareness of international cooperation and coordination.

An example in the Roadmap 2017

Field	Category	Project name	Project overview	Implementing institute	Financial requirement (JPY 100 millions)	Project duration	2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030	Evaluation ①	Evaluation ②	Main outstanding points, etc.	Main tasks, points to keep in mind, etc.	Notes
Clinical medicine	Large research project	Establishment of strategic center for elucidating molecular bases of human diseases based on big data of personal genome	Preparing a "genomic medicine research core," investigating the pathogenic mechanisms of many diseases, such as hereditary diseases, multifactorial diseases, and cancer, through large-scale genome analyses, and promoting development of innovative treatment targeting the molecular mechanisms of diseases	The University of Tokyo (Medical Genomics Research Initiative), National Institute of Genetics, National Center for Child Health and Development, Yokohama City University, National Center for Global Health and Medicine, National Cancer Center Japan	Total amount 193 next-generation sequencers 20, computers 50, operation expenses 123	2016: Preparation of a large-scale genome analysis core 2017: Large-scale genome analysis, start of building a database 2018-2022: Full-scale operation	2016 2017 2022	b	a	● This is a plan that investigates genome factors for multifactorial diseases, etc., and its social significance is high. ● System preparation is proceeding, through establishment of Medical Genomics Research Initiative at the implementing institute and producing results over a three-year period. ● In relationships with other countries where the similar research projects are conducted it is important to promote data sharing under appropriate conditions.	● It is necessary to further clarify strategies aimed at building a system for joint use throughout Japan (a network) and a mechanism for obtaining continuous cooperation from medical institutions throughout Japan. ● Further consideration is necessary in order to proceed as a large research project, because of the fact that the concreteness of huge amounts of research expenses is unclear.	● Based on the Health and Medical Strategies (Cabinet decision on July 2014), etc., related ministries and related organizations are collaborating and promoting initiatives for the purpose of bringing about genomic medicine. Under this project, it is desirable to take consistent initiatives with such nationwide action.
Physics	Large research plan	Particle physics with the High-Luminosity Large Hadron Collider (HL-LHC) HL-LHC	The Large Hadron Collider (LHC) built at the European Organization for Nuclear Research (CERN) will be upgraded aiming for higher luminosity (HL-LHC) around 2024. This makes it possible to search for new particles in a mass region that is much broader than that of LHC. Signs of new physics will also be searched for through detailed measurements of the Higgs boson and other particles.	High Energy Accelerator Research Organization (KEK) is the main contributor in Japan for the accelerator upgrade. The ATLAS experiment is an international experiment, and seventeen Japanese research organizations including KEK and the University of Tokyo are actively participating.	Total amount 104 Accelerator: Superconducting magnets for beam separation 33, Construction burden 25 Detector: Silicon 24, Muon triggers 14, Computers for triggers, etc. 8	2016-2018: Development and prototype manufacturing 2019-2023: Construction 2024-2025: Bringing in, installing, and coordinating detectors 2026-2035: Full-scale operation	2016 2026	a	a	● This project helps strengthen Japan's international role and accelerate development of Japan in the science and technology. ● The project is well prepared with young researchers taking leading roles of the research and development of the upgrade apparatus in Japan.	● A backup plan should be considered in case Japanese contribution is not as the proponents wish (such as the case of lower budget allocation). ● In a public document, "KEK Project Implementation Plan" (KEK- PIP), which defines the priority among future projects at KEK, this project is ranked in the second position. For KEK is the principal institute of the project, a coordination is necessary in the science community, especially with the researchers engaged in its priority 1 project, namely, "nucleon decay and neutrino oscillation experiments using a large and advanced detector".	

From Roadmap 2017 (1)

Field	Category	Project name	Project overview	Implementing institute	Financial requirement (JPY 100 millions)	Project duration
Clinical medicine ゲノム医科学研究拠点の形成	Large research project	Establishment of strategic center for elucidating molecular bases of human diseases based on big data of personal genome	Preparing a "genomic medicine research core," investigating the pathogenic mechanisms of many diseases, such as hereditary diseases, multifactorial diseases, and cancer, through large-scale genome analyses, and promoting development of innovative treatment targeting the molecular mechanisms of diseases	The University of Tokyo (Medical Genomics Research Initiative), National Institute of Genetics, National Center for Child Health and Development, Yokohama City University, National Center for Global Health and Medicine, National Cancer Center Japan	Total amount 193 next-generation sequencers 20, computers 50, operation expenses 123	2016: Preparation of a large-scale genome analysis core 2017: Large-scale genome analysis, start of building a database 2018-2022: Full-scale operation
Physics HL-LHC	Large research plan	Particle physics with the High-Luminosity Large Hadron Collider (HL-LHC)	The Large Hadron Collider (LHC) built at the European Organization for Nuclear Research (CERN) will be upgraded aiming for higher luminosity (HL-LHC) around 2024. This makes it possible to search for new particles in a mass region that is much broader than that of LHC. Signs of new physics will also be searched for through detailed measurements of the Higgs boson and other particles.	High Energy Accelerator Research Organization (KEK) is the main contributor in Japan for the accelerator upgrade. The ATLAS experiment is an international experiment, and seventeen Japanese research organizations including KEK and the University of Tokyo are actively participating.	Total amount 104 Accelerator: Superconducting magnets for beam separation 33, Construction burden 25 Detector: Silicon 24, Muon triggers 14, Computers for triggers, etc. 8	2016-2018: Development and prototype manufacturing 2019-2023: Construction 2024-2025: Bringing in, installing, and coordinating detectors 2026-2035: Full-scale operation

Field	Category	Project name	Project overview	Implementing institute	Financial requirement (JPY 100 millions)	Project duration
Physics	Large facility plan	Nucleon Decay and Neutrino Oscillation Experiment with a Large Advanced Detector ハイパーカミオカンデ	Build the gigantic water Cherenkov detector Hyper-Kamiokande to succeed the Super-Kamiokande experiment. Conduct world-leading neutrino research in combination with the J-PARC accelerator neutrino beam and search for proton decay with unparalleled sensitivity.	The University of Tokyo Institute for Cosmic Ray Research and the High Energy Accelerator Research Organization Institute of Particle and Nuclear studies will lead the advancement of the project in conjunction with anticipated participation from both foreign and domestic universities and research organizations.	Total 1547 (Japan's share: 1393) Hyper-Kamiokande: Construction 675 (551), Operation 400 over 20 years J-PARC: Operation 400 over 10 years Other: Accelerator upgrades etc. 72 (42)	2018-2045: Geologic survey, construction, and operation of Hyper-Kamiokande 2026-2035: High-intensity operation of J-PARC (1.3MW)
Physics	Large facility plan	The next-generation infrared astronomy mission SPICA 次世代赤外線天文衛星	The aim of SPICA is to reveal the process in which the universe has diversified through enrichment of metal and dust, and consequently the habitable worlds have been formed. Under the close partnership between Europe and Japan, SPICA will achieve this aim with a large-diameter, cryogenically cooled telescope, which will enable infrared observations with unprecedented sensitivity.	Japan: Japan Aerospace Exploration Agency (JAXA), Osaka University, National Astronomical Observatory of Japan, The University of Tokyo, Nagoya University, Tohoku University, Kwansei Gakuin University, Kyoto University, others International: European Space Agency (ESA), SAFARI (SPICA Far-Infrared Instrument) Consortium (PI Institute: SRON, the Netherlands)	The total cost is about 100B JPY. The proposed breakdown is that about 30B JPY is by JAXA as a JAXA strategic L-class science mission, and about 550 Euros (70B JPY) by ESA as a Cosmic Vision M-class mission. The exact cost sharing is under discussion.	2016-2022: Design 2023-2027: Fabrication and test 2027-2028: Launch 2028-2030(32): Observation operation

Field	Category	Project name	Project overview	Implementing institute	Financial requirement (JPY 100 millions)	Project duration
Physics	Large research project	LiteBIRD – A Satellite for Exploring the Universe before the Hot Big Bang with Measurements of Cosmic Microwave Background Polarization LiteBIRD	How did the universe begin? The most probable hypothesis to explain the universe before the hot big bang is the cosmic inflation theory. In this project, the polarization of cosmic microwave background radiation will be observed throughout the entire sky to detect the primordial gravitational waves predicted by this theory.	Domestic: Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency (JAXA) / Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU, WPI), UTIAS, The University of Tokyo / Institute of Particle and Nuclear Studies, High Energy Accelerator Research Organization (KEK) Foreign: National Aeronautics and Space Administration (NASA), University of California	Total amount approx. 300 (as Japan's burden) Mission instruments (observation instruments) development expenses approx. 100, satellite development expenses approx. 125, a rocket approx. 50, launch and operation approx. 25	2016-2018: Preparation period 2019-2025: Design, production, launching 2026-2028: Observation 2029-2032: Announcement of results
Chemistry	Large facility project	Attosecond Laser Facility アト秒レーザーALFA	Four soft X-ray attosecond beam lines will be constructed, as well as time-resolved spectroscopic instruments and microscopes with attosecond analysis abilities. In addition, laser plasma acceleration will be integrated with attosecond laser technology, leading to the development of next-generation attosecond light source technology.	The University of Tokyo will be the core organization, and researchers from RIKEN, universities, research organizations, and private-sector companies throughout Japan will participate. A facility preparation committee, a use promotion committee, and an analysis support committee will be established as executing organizations.	Total amount: 96 Construction and development of the core facility: 74 Measuring instruments: 14 Operational costs: 8	2017-2018: Construction period 2019-2022: Partial operation 2023-2026: Full-scale operation
Integrated fields that are related to two or more fields	Large facility project	Project of a low emittance synchrotron radiation facility for the establishment of a coming world leader in science and technology SLiT-J	Further development of materials and life sciences will be aimed for, and prompt construction and beginning of operation of a 3GeV-class high-brilliant synchrotron radiation facility based on low-emittance operation and insertion devices, with low-cost construction and energy-conserving operation in the fundamental design concept.	Leading institutions in synchrotron radiation research such as RIKEN will organize a nationwide cooperation system for the construction and operation of a proposed facility. Beamline construction will be conducted by an organization formed by adding to the aforementioned organizations the organizations that apply from academic and industrial circles.	Total amount 300 Medium-energy synchrotron radiation facility construction 250, beamline construction 30, operation expenses 20 (*Land acquisition expenses not included)	2016: Decision on a design concept 2017-2020: Construction of the synchrotron radiation facility and beamlines 2021: Beginning of test operation

From Roadmap 2017 (2)