GNSS Application Catalogues User Requirement and User Questionnaire
Status and Near-term Plan

By ICG WG-B Application Subgroup

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International Committee on Global Navigation Satellite Systems

OUTLINES

1. ICG WG-B AppSG – organizational change
2. Backgrounds and motivations
3. GNSS Application Catalogues Update
4. User Requirement Electrical Questionnaire
   - Function definition and system design
   - Questions allocations and logic
5. Near-term Plan

ICG-WG B Application Subgroup: Organizational Change

- New appointments of both co-chairs of AppSG have been changed since ICG-12.
  - Dr. Jun Shen, Chief Scientist, Beijing UniStrong Science and Technology Co. Ltd. was appointed to the co-chair representing China
  - Dr. Izumi Mikami, Senior Executive Director, Satellite Positioning Research and Application Center (SPAC) was appointed to the co-chair representing Japan
- The co-chairs would appreciate for the member states to update their nominations for their representative(s) in the AppSG.

Backgrounds

- Mission Review
  - Task from ICG-9 on Application Catalogues
    - To compile the findings in a report
    - The target is to quantify a range for the user needs per application domain and consequently make catalogues
  - Task from ICG-10 on Requirement Questionnaire
    - ICG Participants are invited to fill questionnaire and feedback to co-chairs
    - Questionnaire will be made available at ICG website
  - At ICG-11, the electronic version (APP) version 1.1 was presented

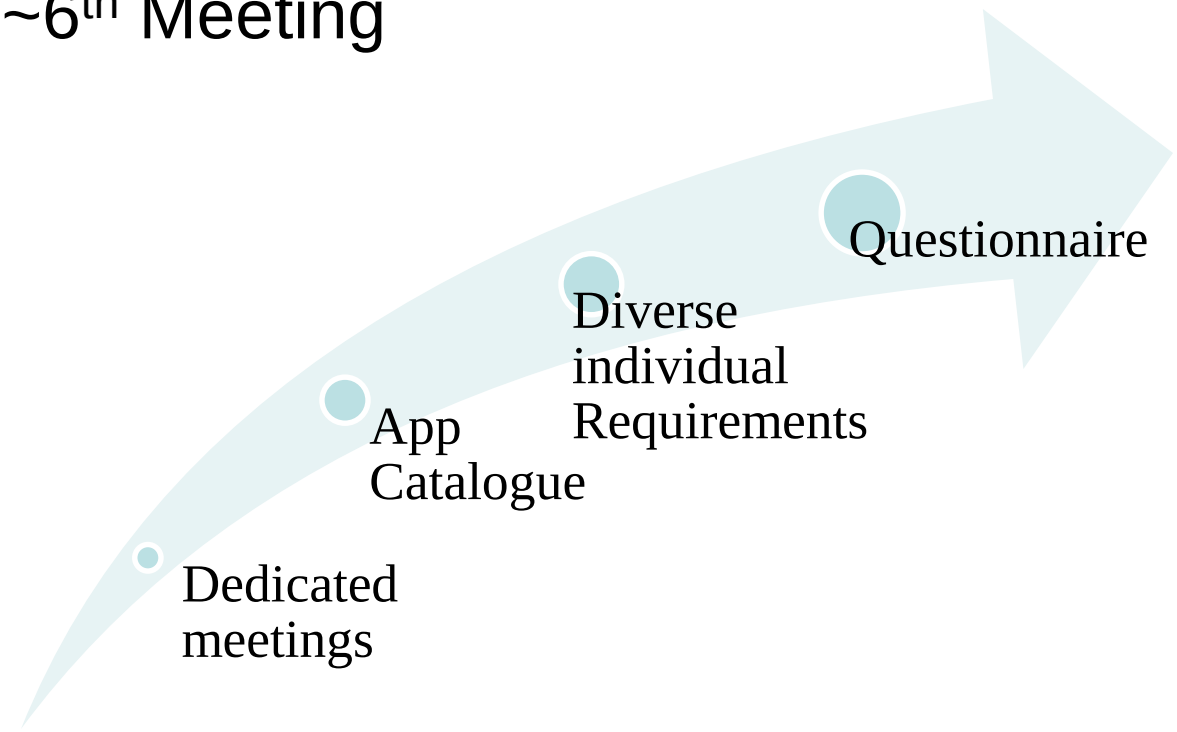
Backgrounds

App SG Meetings Summary since ICG-6

Mtg	Venue	Date	Theme	In conjunction with
1st	Munich, Germany	2012/03/12,13	App on Mass Market Liability	Munich Summit
2nd	Wuhan, China	2013/05/14	App on Surveying, Disaster Management, Maritime, Liability	China Satellite Navigation Conference
3rd	Daejeon, Korea	2013/07/18	App on Disaster Management, Agriculture, Surveying, Timing	National GNSS Research Center Symposium
4th	Jeju, Korea	2014/10/22	App on SBAS, Surveying, Mass Market, Disaster	International Symposium on GNSS
5th	Vienna, Austria	2015/06/10	Application Catalogue Architecture	ICG series meetings
6th	Munich, Germany	2016/03/01	Catalogue Architecture and methodology	Munich Summit

Backgrounds

- Outcomes from App SG meetings
  - Core applications and enabling technologies were identified during SG 1st~4th Meeting;
  - Application Catalogue were defined during SG 5th~6th Meeting



Motivations

- Questionnaire benefits to WGB
  - To provide sufficient and significant data for GNSS application report
  - To provide a guideline for WGB future work
- Questionnaire benefits to application domains
  - To identify GNSS performance requirements in each domain as many as possible
  - To offer suggestions to GNSS service providers and product manufacturers

Application Catalogues Updates

- In the current version, 8 different application domains In total are covered and ranges for performance targets are identified

1. Personal Navigation
2. Timing
3. Real-Time Monitoring
4. Space Utilities
5. Disaster Management
6. Transportation
7. Agriculture
8. Surveying & Mapping

- The achieved performance targets are expected to find a requirement balance between the user community and the service providers through a joint effort.

Application Catalogues Updates

Domain 1	Personal Navigation(1/2)

Field	Function	precision	comments
Pedestrian	Sightseeing	/5m ～ 10 m /1m ～ 2 m	/ Find and navigate to a place where you want to go / information with Augmented Reality
	Shopping	1m ～ 2 m	Find and navigate to a shop where you want to go
	Disable people guidance	0.5m ～2 m	Wheelchair navigation
Personal monitoring	Safety monitoring	5m ～ 10 m	Body guards
	Guardianship	5m ～ 10 m	Watching for children, the sick and the aged safety

Application Catalogues Updates

Domain 1	Personal Navigation(2/2)

Important mentions
/ Multi-GNSS, especially with hybrid constellation are effective for improving the availability even on city canyon
/ indoor-outdoor seamless PNT services are highly required
/ indoor positioning using WiFi, Bluetooth, IMES, etc. are discussed now
/ hand-carry based equipment like cellar phone is really important to grow the market
/ message authentication is really required, especially to use the guidance for disable people

Application Catalogues Updates

Domain 2	**Timing**

Field/Function	precision	comments
Power grid time synchronization	<50ns	This function is critical for widespread areas and regions
Communication base station time synchronization	<1.5µs	It is important for the integrity of communication systems
Electronic business transaction	~10ms	Standardization between transactions is required

Important mentions
/ the goal is to replace high precision atomic clock installed in these systems
/ time information error detection is a critical function
/ message authentication is really required, especially to use the electronic business transaction

Application Catalogues Updates

Domain 3	**Real-time Monitoring**	
Field/Function	**precision**	**comments**
Tailings monitoring	1cm ~ 5cm	Safety insurance
Bridge health monitoring	1cm ~ 5cm	Trend data, Continuous monitoring
Dam monitoring	1cm ~ 5cm	Trend data
Building monitoring	1cm ~ 5cm	Trend data, Wind load
Landslide monitoring	1cm ~ 5cm	Trend data, Predict disaster damages and reduce ones
Railway track	1 mm ~ 1 cm	Trend data

Important mentions
/ high precision and integrity are required
/ reliable information network is one significant part
/ collaborate with communication systems

Application Catalogues Updates

Domain 4	Space Utilities

Field	Function	precision	comments
TSV	**Attitude Determination**	0.2˚ ~ 0.4˚	Low-cost
	Orbit Determination	10m ~ 100m	High dynamic range
	Rendezvous & Docking	1cm ~ 10cm	High-precision required
SSV	**GEO Orbit Determination**	10m ~100m	Weak signals Few satellite signals
Beyond SSV	**Lunar Exploration**	100m ~1000m	Even Weaker and fewer
	Mars Exploration	100m ~1000m	Even Weaker and fewer

Important mentions
/ enough GNSS satellites is the most important issue
/ weak signal process methods need to be researched in depth
/ Multi-constellation interoperability

Application Catalogues Updates

Domain 5	Disaster Management

Field/Function	precision	comments
Earthquake	1cm ~ 5m	Earthquake prediction Rescue after disaster occurred
Volcano	1cm ~ 10m	Volcano prediction Rescue & keep off disaster area
Forest fire	5m ~ 10m	Forest fire-spread prediction Rescue & keep off disaster area
Mudslide	A few mm ~ 1cm	Mudslide prediction Rescue & keep off disaster area
Flood	5m ~ 10m	Rescue after disaster occurred

Important mentions
/ 3S(GNSS & Remote Sensing & GIS)+C(Communication) are really important
/ Short message is really useful because ground stations in disaster area are mostly collapsed
/ indoor-outdoor seamless PNT services are required, especially to rescue.

Application Catalogues Updates

Domain 6	**Transportation**

Field/Function	precision	comments
Road (car, bike)	10cm ～ 2m	Traffic control, automatic-driving Accuracy requirement leaded on tire size ,body size or road-lane size
Water (ship)	1cm ～ 10m	Ship control (e.g. bring a ship along the pier) Presence for safety
Rail (train, streetcar)	1cm ～ 15m	rail parallel management train operation management & control
Road pricing	1 m ～ 5 m	Concern in the traffic management, environmental management, or so on

Important mentions
/ the integrity and the authentication are especially required
/ combination with other positioning system like gyro is recommended
/ Multi-GNSS, especially with hybrid constellation is effective for improving the availability even on city canyon
/ Coordination between position and map is important, especially cm-level

2. Application Catalogues Updates

Domain 7	**Agriculture**

Field/Function	precision	comments
Robot and auto-guidance system	A few cm ~ 30 cm	To be determined with working field size

Important mentions
/ IT agriculture market is expected to grow as the farmer aging and the world population growing

Application Catalogues Updates

Domain 8	***surveying & mapping***

Field/Function	precision	Comments
Surveying	A few mm ～ 0.5 m	/ depend on users
Registry of land	A few mm ～ 3 cm	/ depend on country law
Mapping	0.1m ～ a few m	/ Map for automatic driving is requested for high accuracy. / depend on users

Important mentions

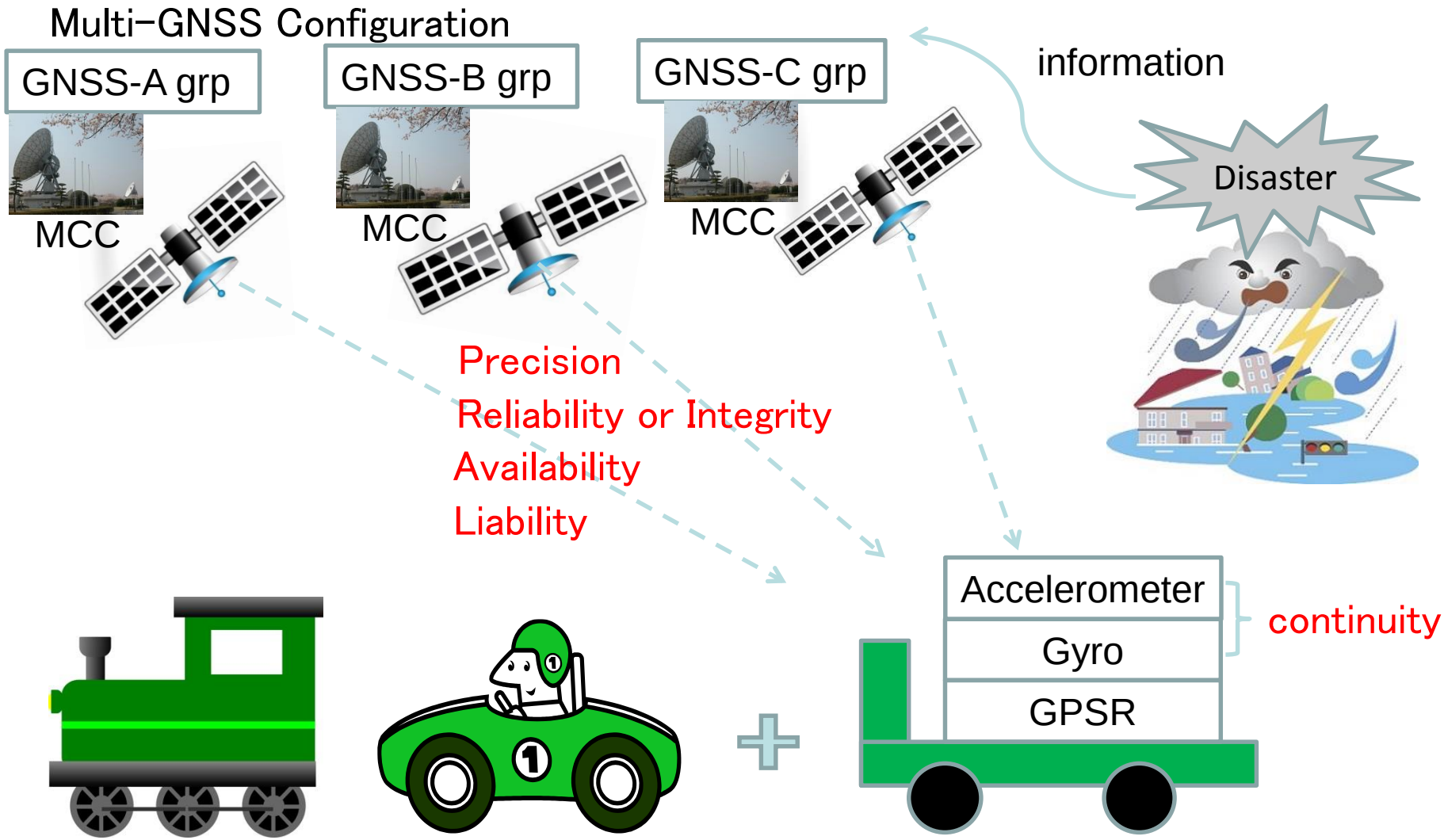
Application Catalogues Updates

Domain 9	**Others**

Field/Function	precision	comments
Aviation	Detailed by ICAO	No further discussion but its requirements would be cited in the catalogues
Meteorology & Hydrology	TBD	Lack of detailed presentations in the previous App SG meetings

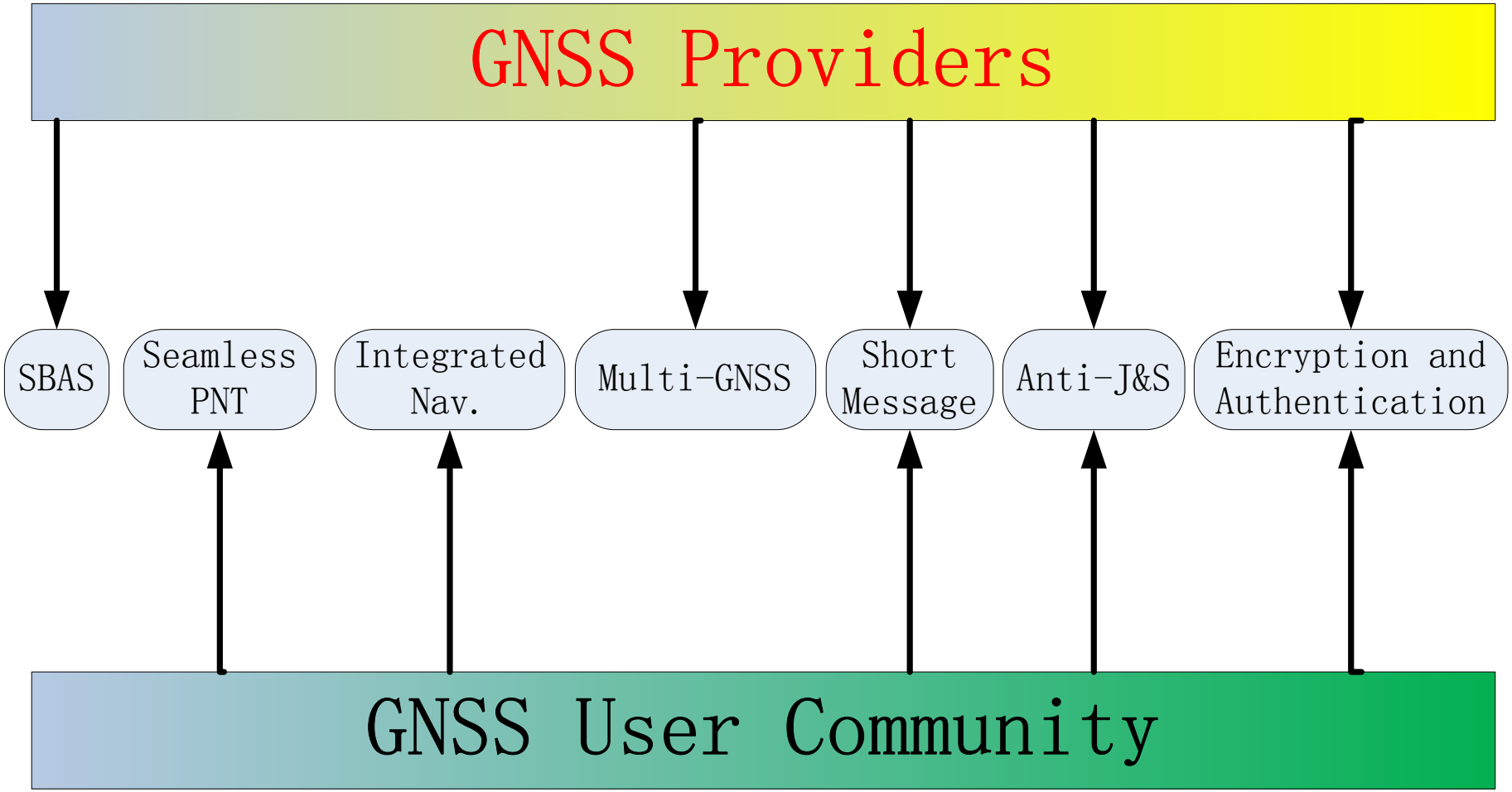
Important mentions
/ There are increasing new GNSS applications not included in our past presentations
/ The subgroup will invite new emerging applications and take them in the classification as updates

Application Catalogues Updates



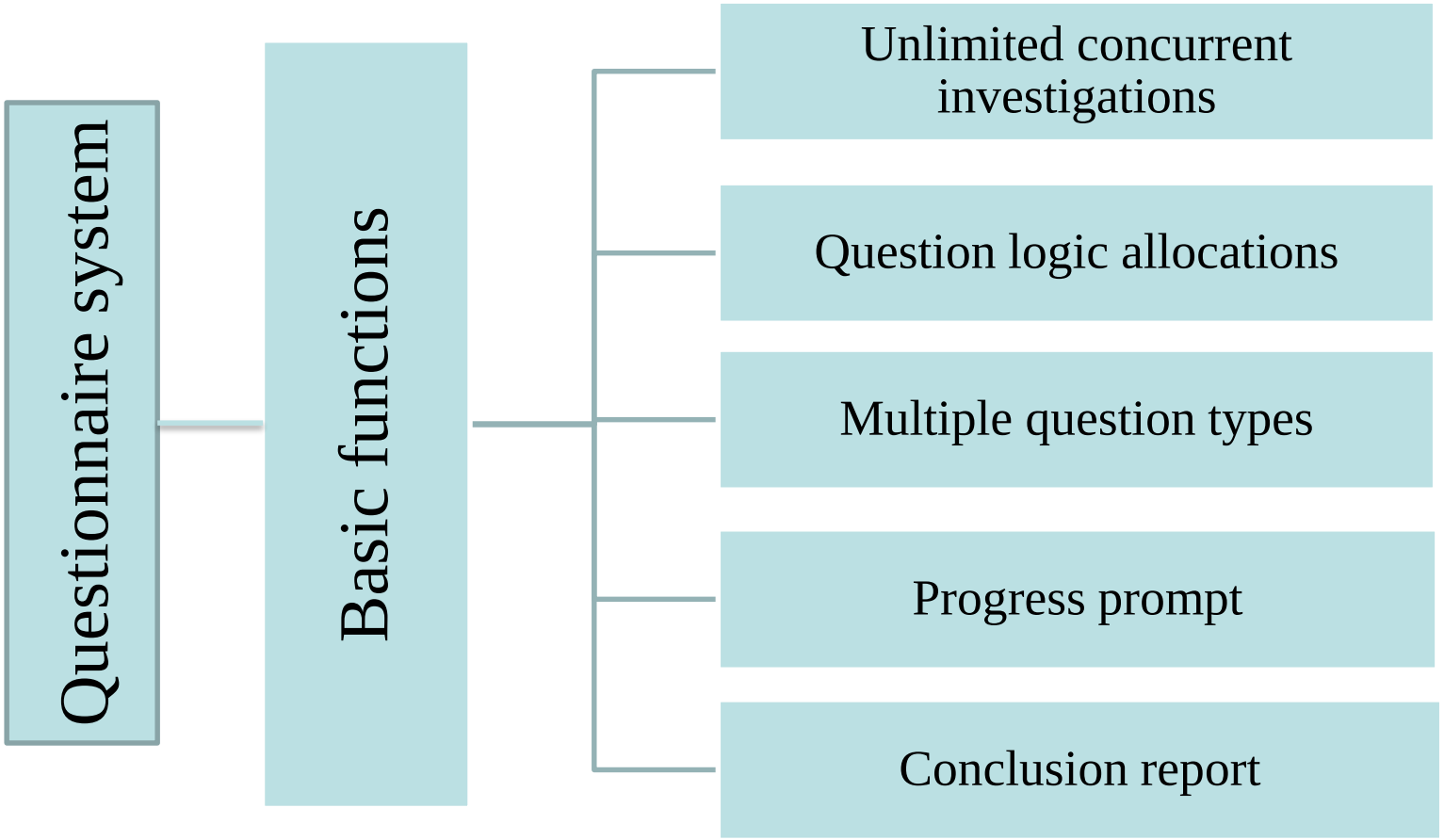
Requirement Trends

Application Catalogues Updates



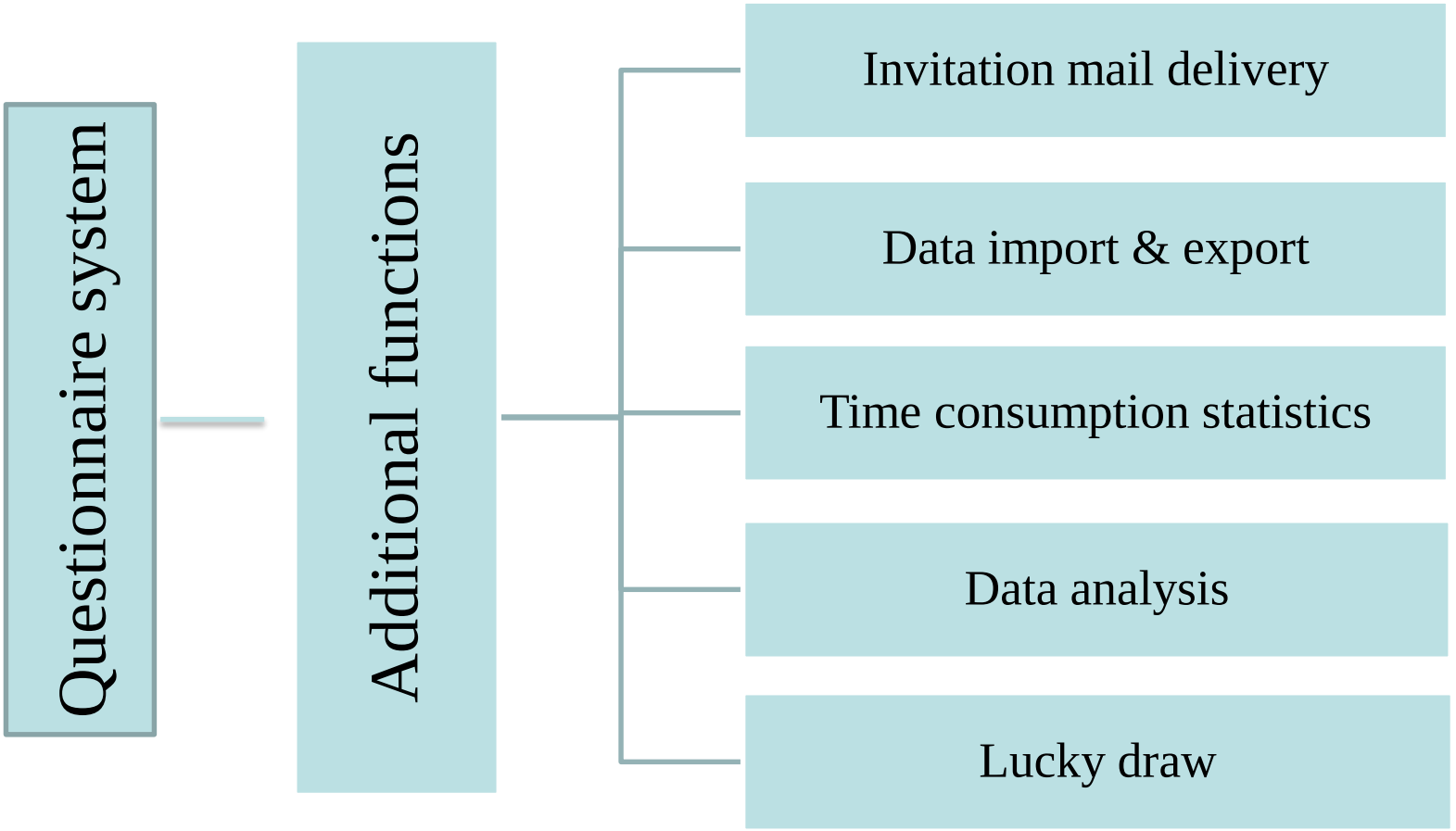
Technical Trends

Electronic Questionnaire



Function Definition – Basic

Electronic Questionnaire



Function Definition – Additional

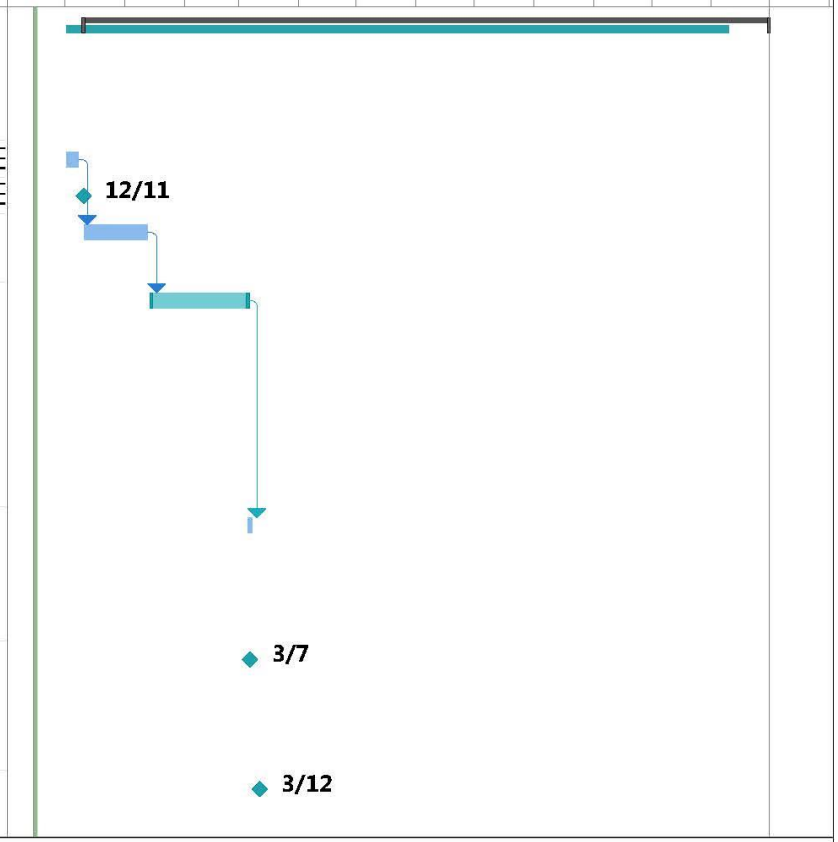
New Add-on items

- Investigation of User requirements on GNSS+ Applications
  - Fusion of GNSS and ground PNT services
  - Fusion of GNSS and other sensors positioning
  - Fusion of GNSS and other messaging services
  - GNSS applications in Search & Rescue (SAR)

Near-term Plan

- Distribute the current version at ICG-12 Meeting for future consideration and improvements.
- Develop the questionnaire in paper and http formats, possibly in multi-language format (English, Chinese, Japanese, etc)
- Release modified questionnaire UNOOSA ICG portal.
- Distribute the questionnaire through various conferences and channels (*See next 3 pages for tentative upcoming AppSG meeting schedule before ICG-13. The meeting schedule could be adjusted according to the progress of the AppSG working plan*).
- Collect the data and complete an initial analysis
- Present the first draft of user requirement report at ICG-13 Meeting

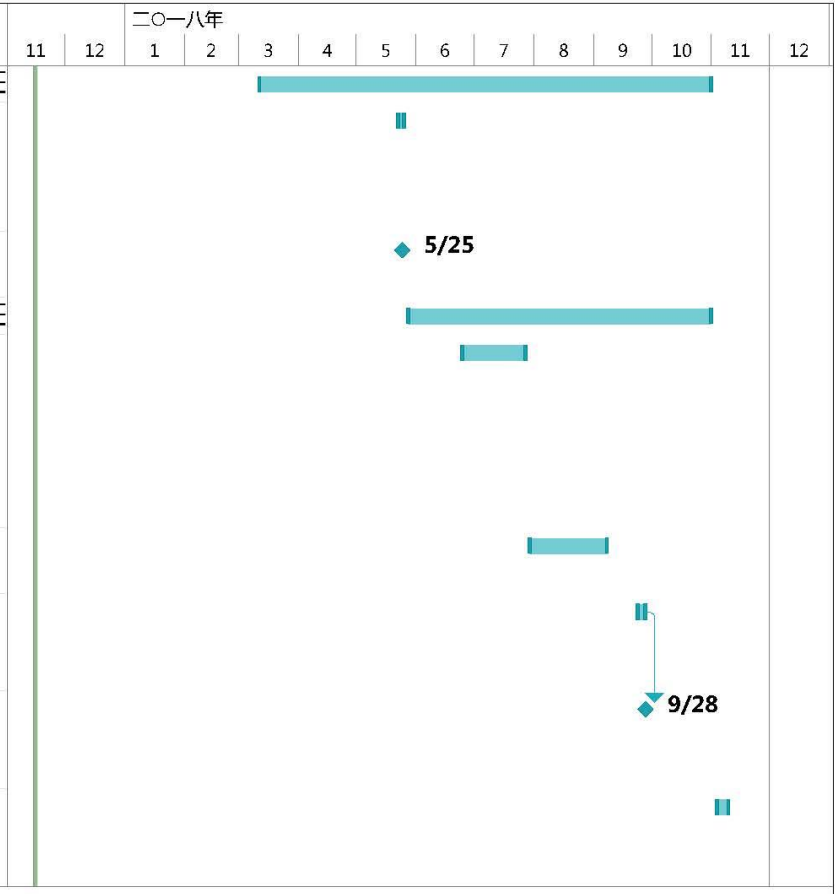
标识号		任务模式	任务名称	工期	开始时间	完成时间
1			**GNSS Application Catalogues User Requirement and User**	**255 个工作日**	**2017年12月11日**	**2018年11月30日**
2			ICG-12	5 个工作日	2017年12月2日	2017年12月7日
3			Revision task starts	0 个工作日	2017年12月11日	2017年12月11日
4			Collect comments for	25 个工作日	2017年12月11日	2018年1月12日
5			Revision of the E-Questionnarie, Development of the questionnarie in paper and http formats. Possiblly in multiple-language	36 个工作日	2018年1月15日	2018年3月5日
6			AppSG Meeting 2018-1 at Munich Satellite Navigation	2 个工作日	2018年3月6日	2018年3月7日
7			Agreement on the modification items on the Catalogues and Questionaire	0 个工作日	2018年3月7日	2018年3月7日
8			Release v2.0 on UNOOSA ICG Portal	0 个工作日	2018年3月12日	2018年3月12日



Project: Simple Project Plan
Date: 2017年11月16日

Task		Inactive Summary		External Tasks	
Split		Manual Task		External Milestone	
Milestone		Duration-only		Deadline	
Summary		Manual Summary Rollup		Progress	
Project Summary		Manual Summary		Manual Progress	
Inactive Task		Start-only			
Inactive Milestone		Finish-only			

标识号		任务模式	任务名称	工期	开始时间	完成时间
9			Data Collection Proce	168 个工作	2018年3月12日	2018年10月31日
10			AppSG Meeting 2018-2 at China Satellite Navigation Conference, Harbin,	3 个工作日	2018年5月23日	2018年5月25日
11			Agreement on the analysis method	0 个工作日	2018年5月25日	2018年5月25日
12			Analysis Process	113 个工作	2018年5月28日	2018年10月31日
13			Establishment of the initial draft template of the user requirement report and share the template to each	25 个工作日	2018年6月25日	2018年7月27日
14			The first draft of the user requirment	30 个工作日	2018年7月30日	2018年9月7日
15			AppSG Meeting 2018-3 at ION GNSS+ 2018, Miami,	4 个工作日	2018年9月24日	2018年9月27日
16			Agreement on the first draft of the user requirement report	0 个工作日	2018年9月28日	2018年9月28日
17			Present the user requirement report at ICG-13, Xi'an,	6 个工作日	2018年11月4日	2018年11月9日



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GNSS Application Requirement Questionnaire (v1.1)

Website: http://121.42.29.87/index.php/377458?lang=en

Investigation would need about 15 minutes

We would like to request each member state, to assign organization in charge to cooperate to collect answers to the questionnaire and analyze data on each country basis, and cooperate to make up the 1st draft of user requirement report.

THANK YOU FOR YOUR ATTENTION

If you browse the questionnaire and share it to your colleagues. Students. And customers,

it would be highly appreciated.