



GRAD Driving Innovation for
Safer Maritime Navigation

DGPS User Consultation

Input to IALA ENG12 & ARM 12

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GLA DGPS System Director

GLA DGPS

- GLA operate 14 DGPS reference stations
- Hardware was recapitalised in 2008
- Current hardware is approaching end of life
- User consultation was launched to capture user requirements for a future system



User consultation



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- Consultation being completed in two phases
 - Online survey (quantitative response)
 - Face-to-face (qualitative response)
- Survey circulated to a wide user base
 - 153 respondents (+2 very late submissions not considered)
 - Marine users - Commercial mariners, leisure users, hydrographers, harbour masters, pilots etc.
 - Non-maritime users - land surveyors, utilities companies, farmers, military/government etc.
- Face-to-face interviews
 - 26 vessel crews, 1 nautical college class & 1 lead pilot.
- Considering current and future user requirements



Survey development



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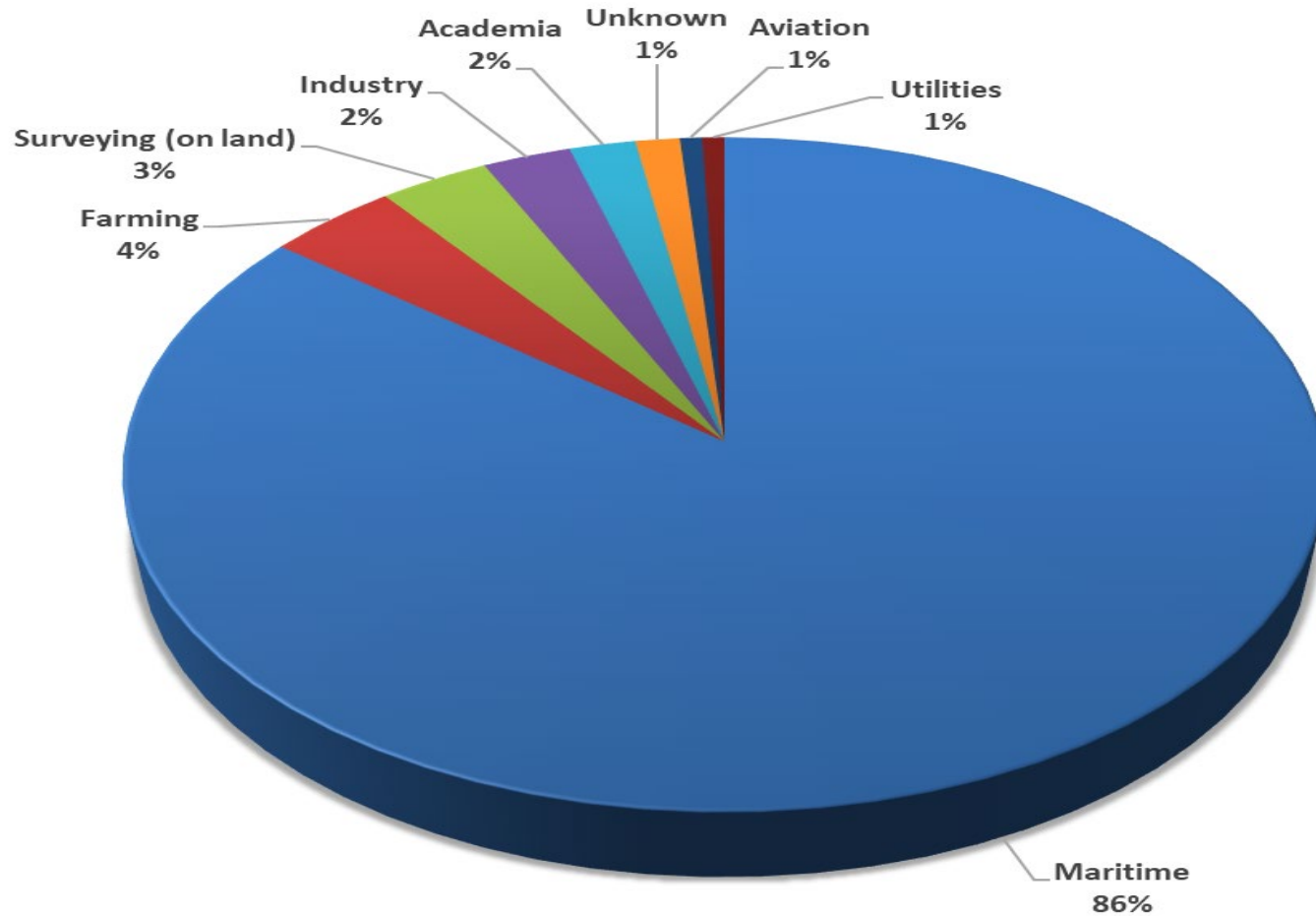
- GLA survey was based on one conducted by AMSA in 2014 that received 131 responses.
- Survey was widely advertised via:
 - all three GLA websites and light dues agents
 - maritime representative bodies
 - maritime organisations (e.g. port authorities)
 - maritime publications
 - Maritime related government bodies (e.g. defence, police),
 - non-maritime avenues (e.g. farming groups & utilities companies)
 - and directly to companies, users and nautical colleges
- Survey sent to over 100 bodies/organisations/companies early July 2018 with a closing date of Dec 31st 2018.
- All questions were optional and to comply with UK data protection legislation all identifying data was deleted (both online and within GRAD) at the end of April 2019.

Respondents



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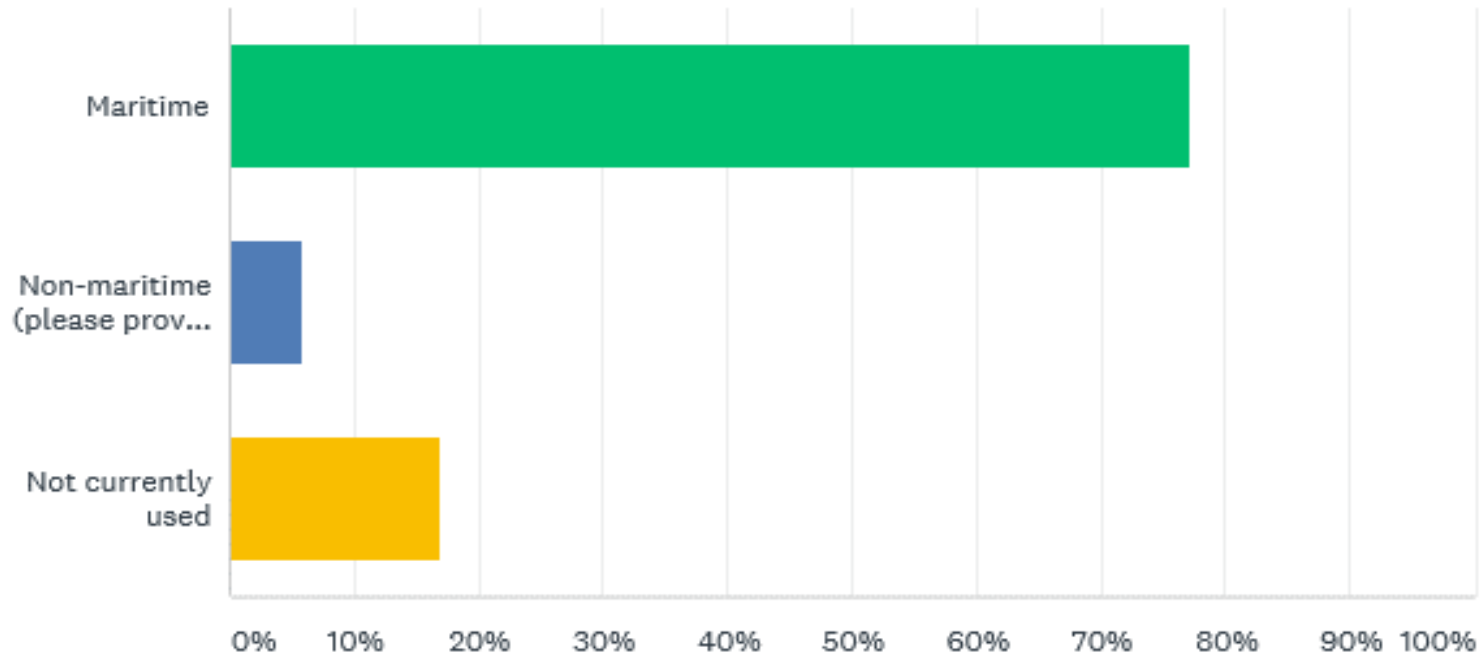


User context



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- The vast majority of respondents use the GLA system in a maritime context.
- Non-maritime users were removed from data pool
- Maritime users reporting that they do not use the system were retained.
- Leaving 130 respondents in the data pool going forward.


Maritime users include:

Masters, Navigating Officers, Officer of the watch, harbour masters, deep sea pilots, hydrographic surveyors, dynamic positioning operators, navy/defence roles, leisure sailors, cadets, yacht masters and harbour/deep sea pilots.

Non-maritime users include:

Farmers, academic researchers, engineers, geodesists and manufacturers.

Maritime users were grouped into the following:

- Commercial mariners (all people driving commercial ships, ex. pilots – 84)
 - Leisure users (all leisure users – 5)
 - Marine operators (specific users not driving ships e.g. harbour master, DP operator – 26)
 - Pilots (deep sea and port pilots – 15)
- 

Survey sections



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The survey was broken into several parts

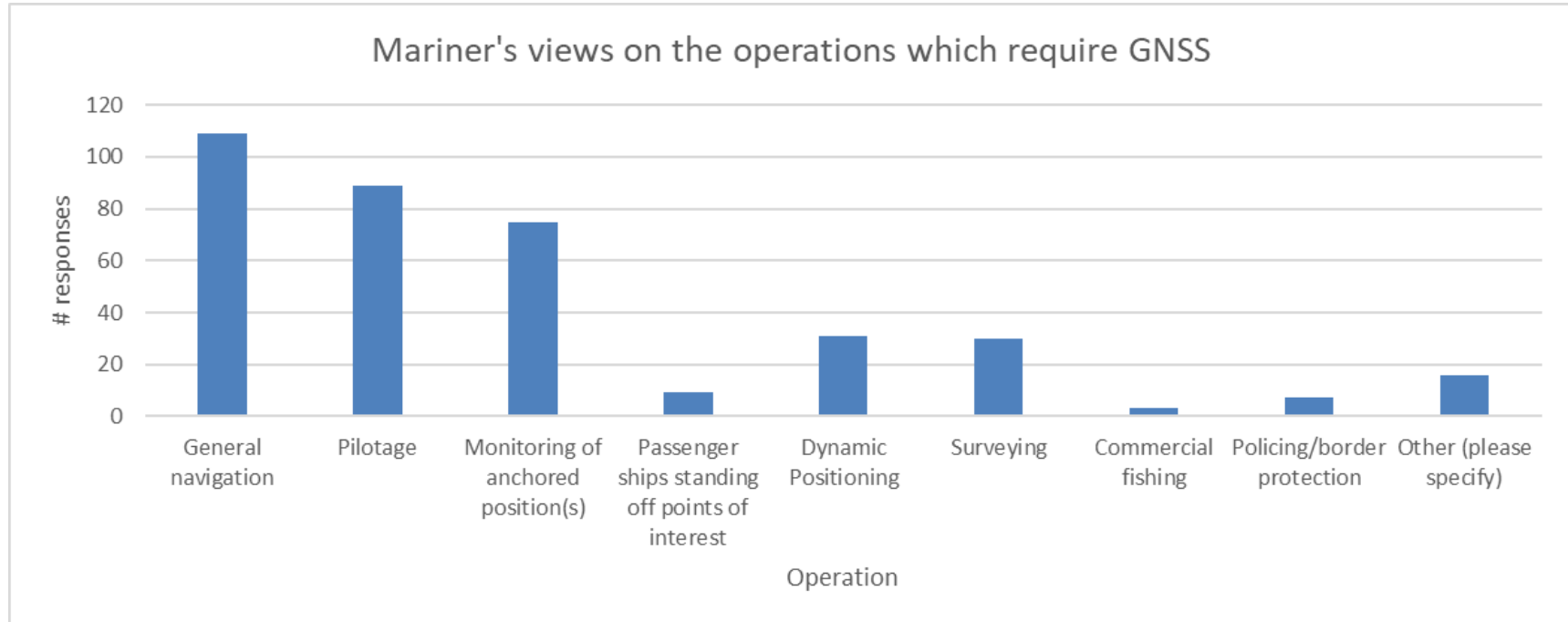
- How is the GLA DGPS system used today and why?
- Do mariner's use alternatives too?
- What are the mariner's future requirements?
- What is the expected impact to the mariner if the GLA DGPS service was closed?

GNSS use



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Results show use of GNSS in common operations (General navigation) with less use for fishing.

Other included specific operations (e.g. maritime defence operations, VTS, radio communications)

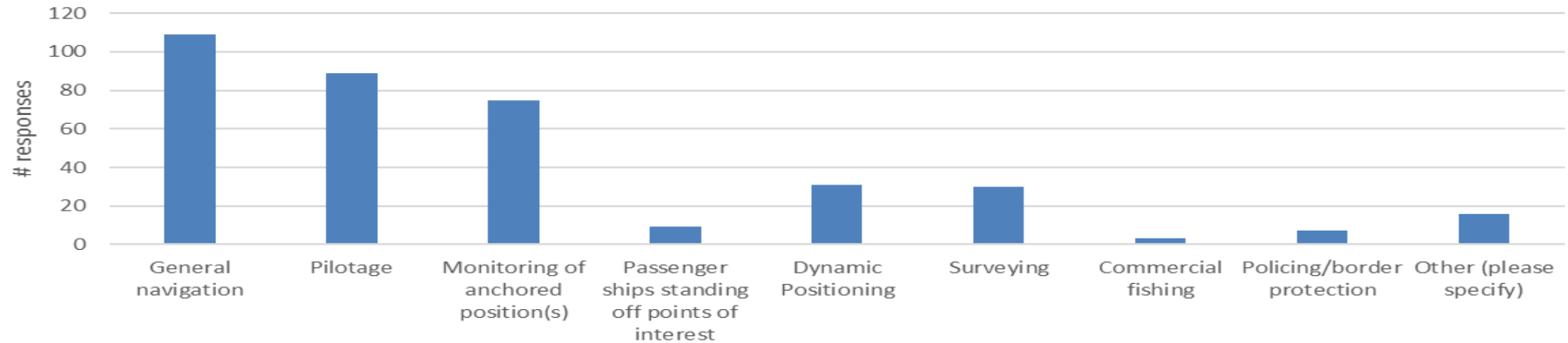
DGNSS criticality (all responses)



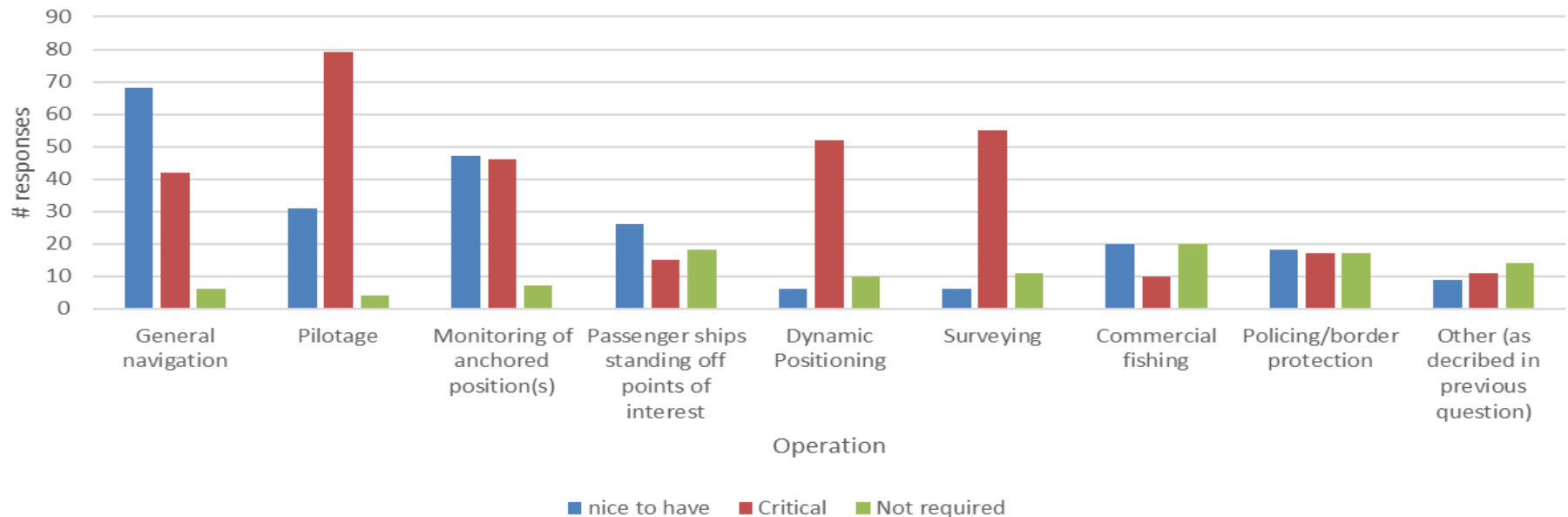
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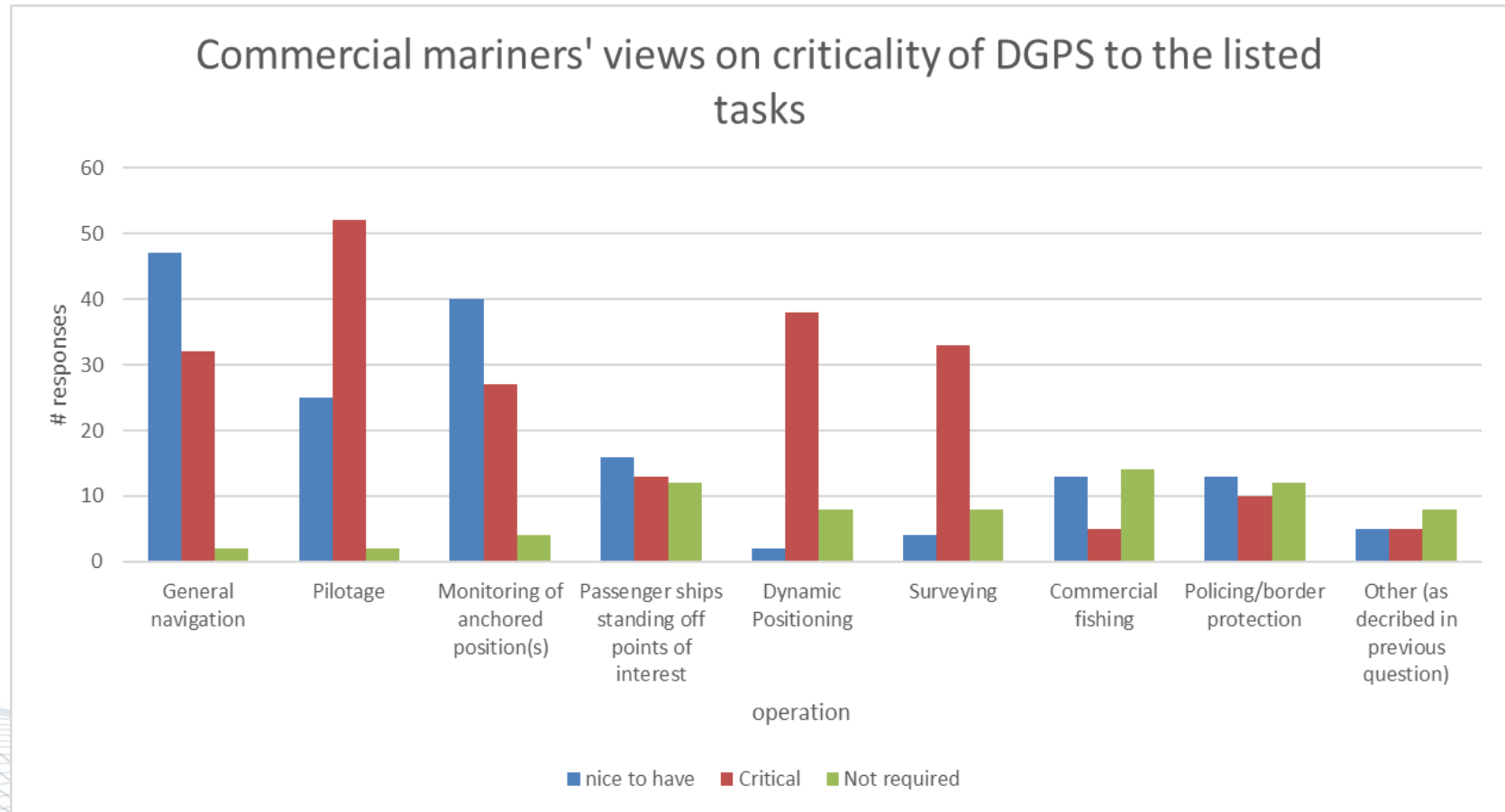
Mariner's views on the operations which require GNSS



Collective view of whether DGPS is a nice to have, critical or not required for key operations



DGNSS criticality (commercial mariners)



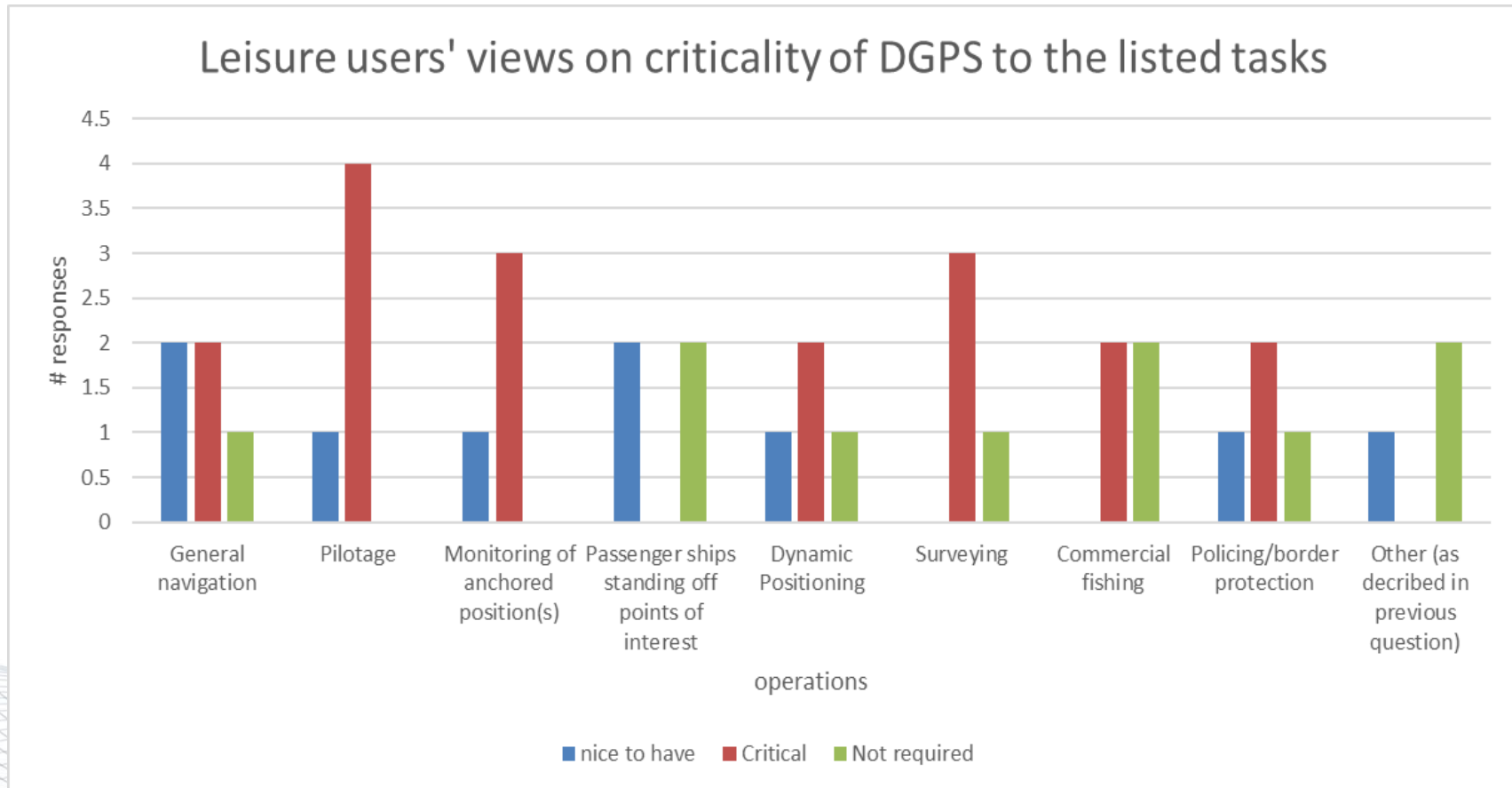
- A mixed view – many saying nice to have, critical or not required to each operation.
- 84 respondents

DGNSS criticality (leisure)



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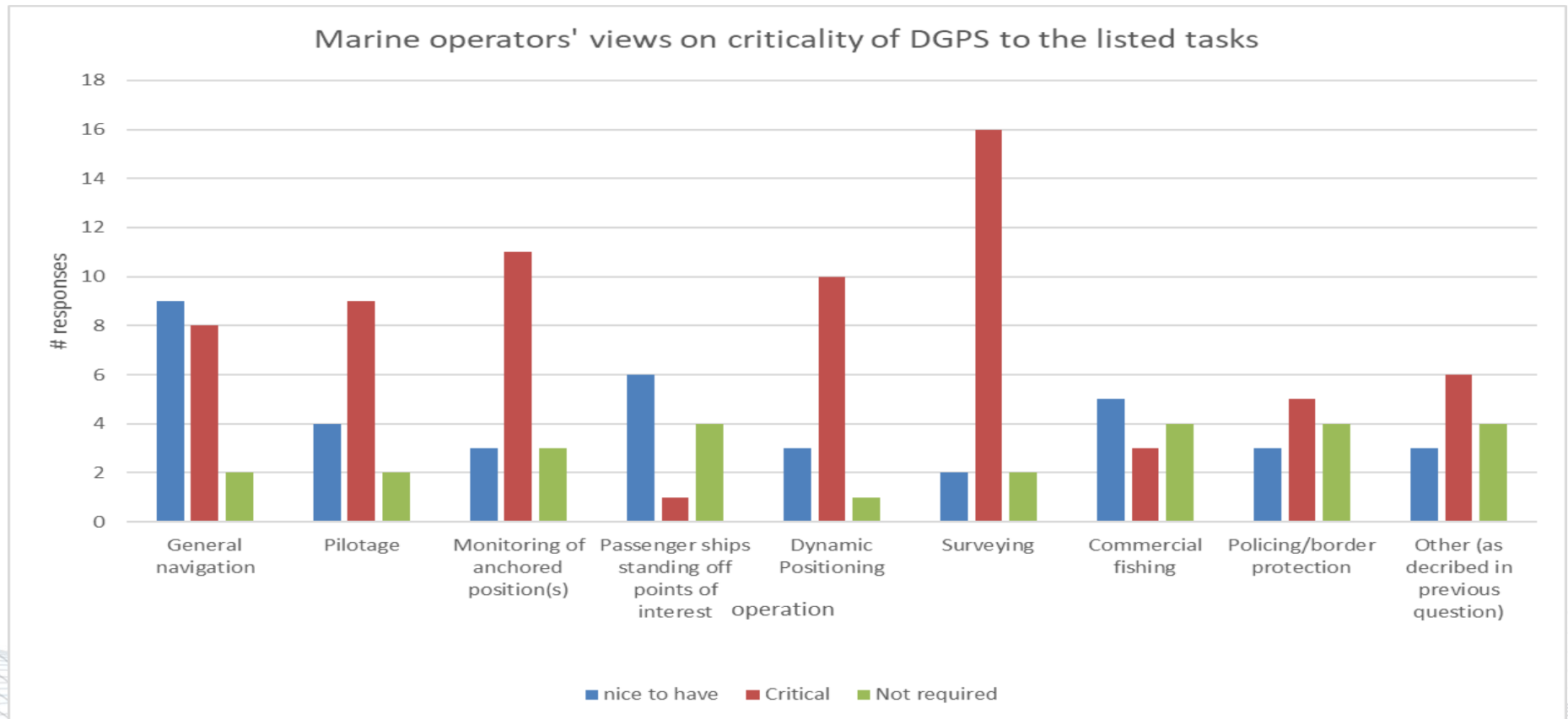
- Quite a mixed view - insufficient responses to see any trend.
- 5 respondents

DGNSS criticality (marine operators)



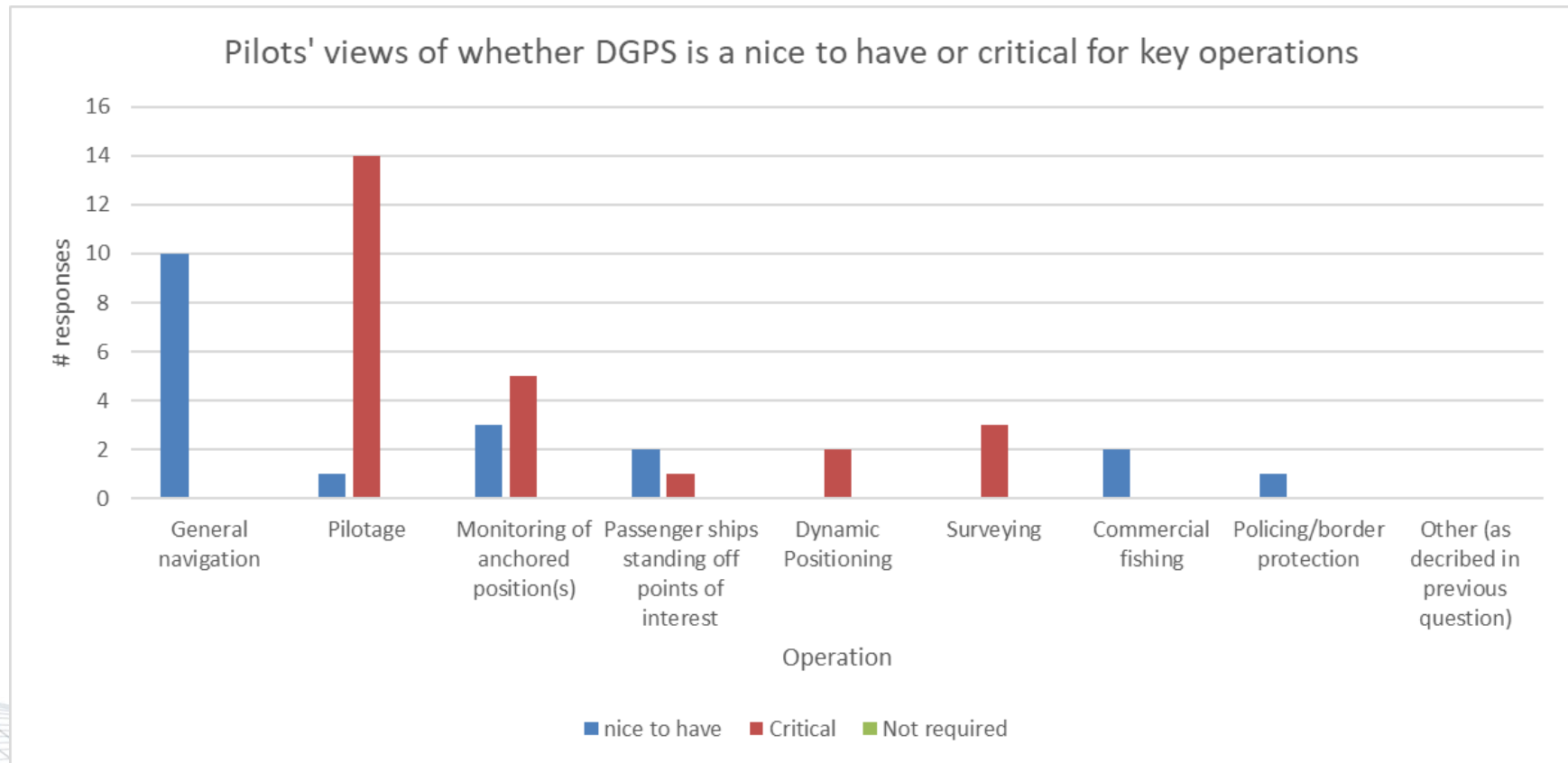
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- Marine operators include DP operators, hydrographers as well as harbour masters and other specific roles.
- 26 respondents

DGNSS criticality (pilots)



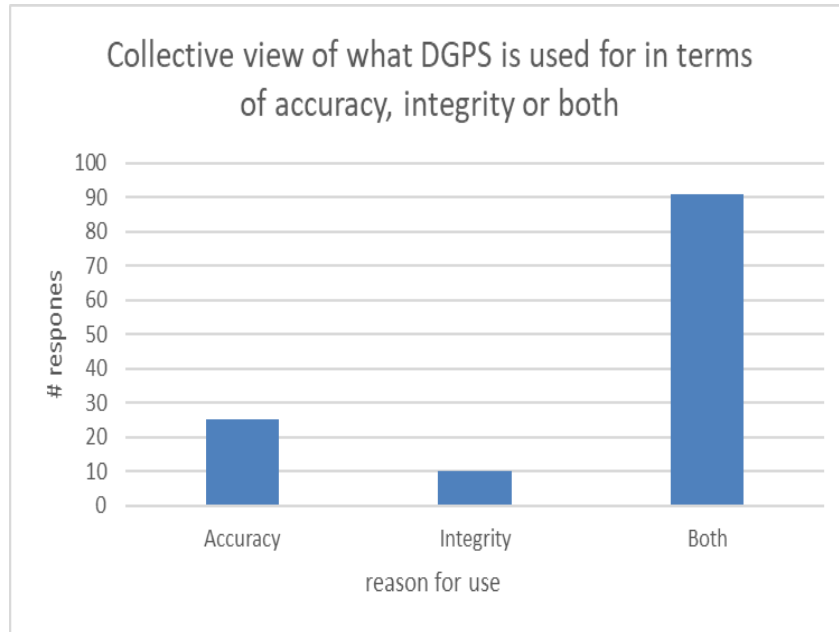
- Responses either nice to have or critical – nothing marked as not required
- Requirement for pilotage – the respondents key operation
- 15 respondents

Reason for using DGPS

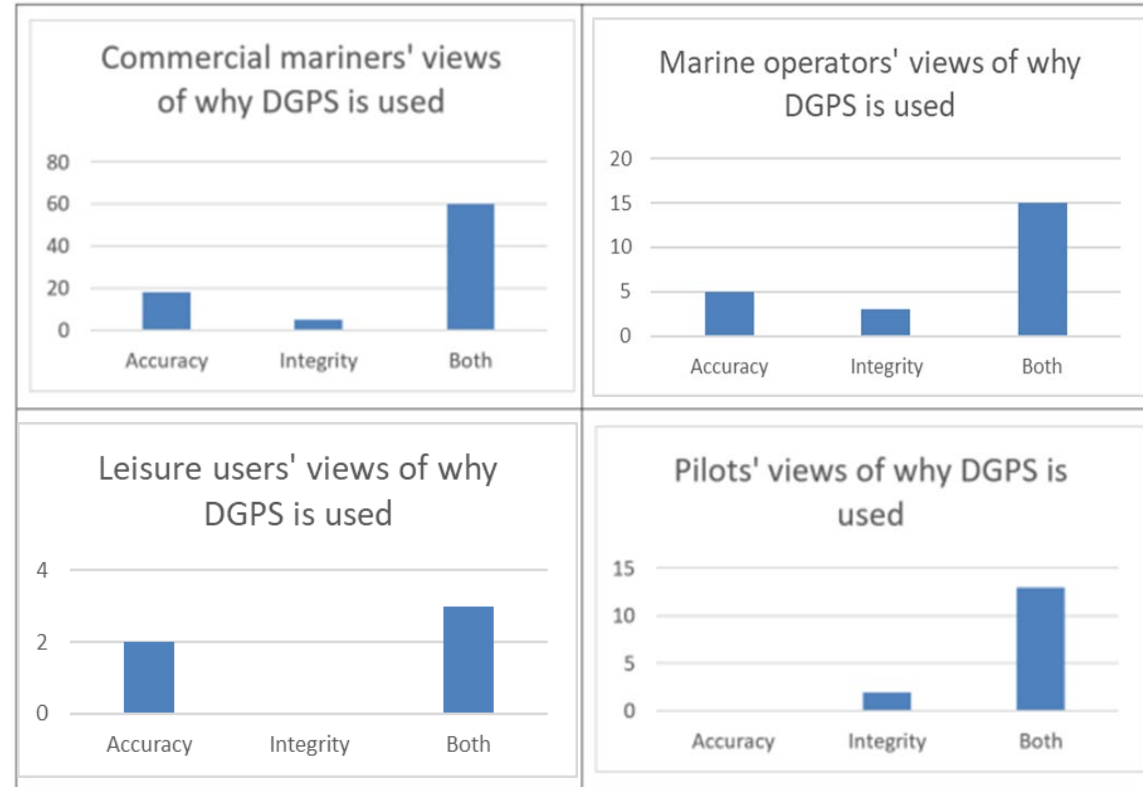


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All respondents



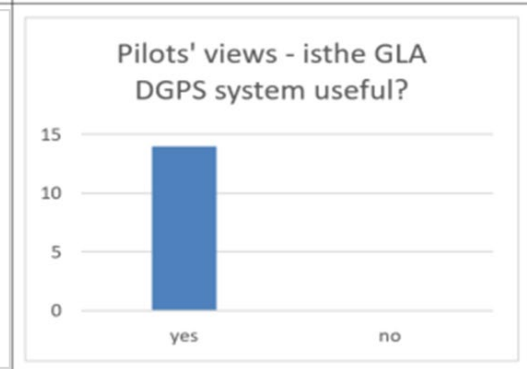
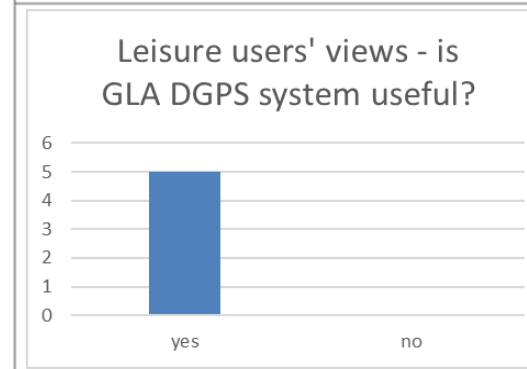
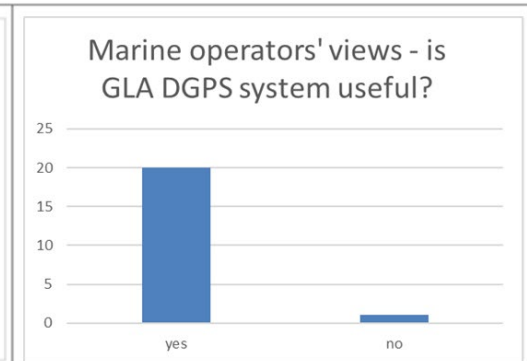
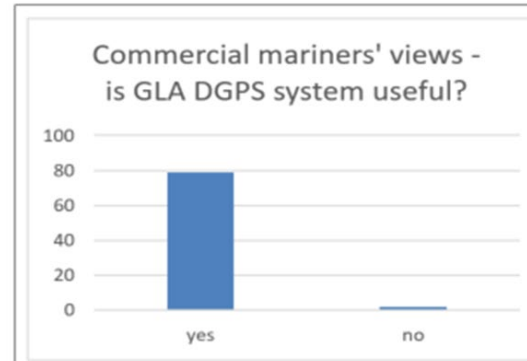
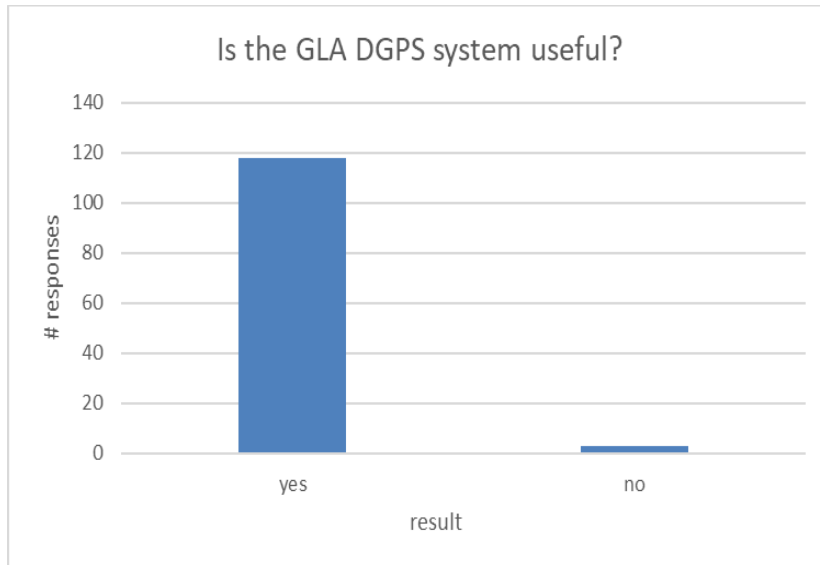
Respondents use the GLA system for integrity and accuracy improvements.

GLA DGPS performance



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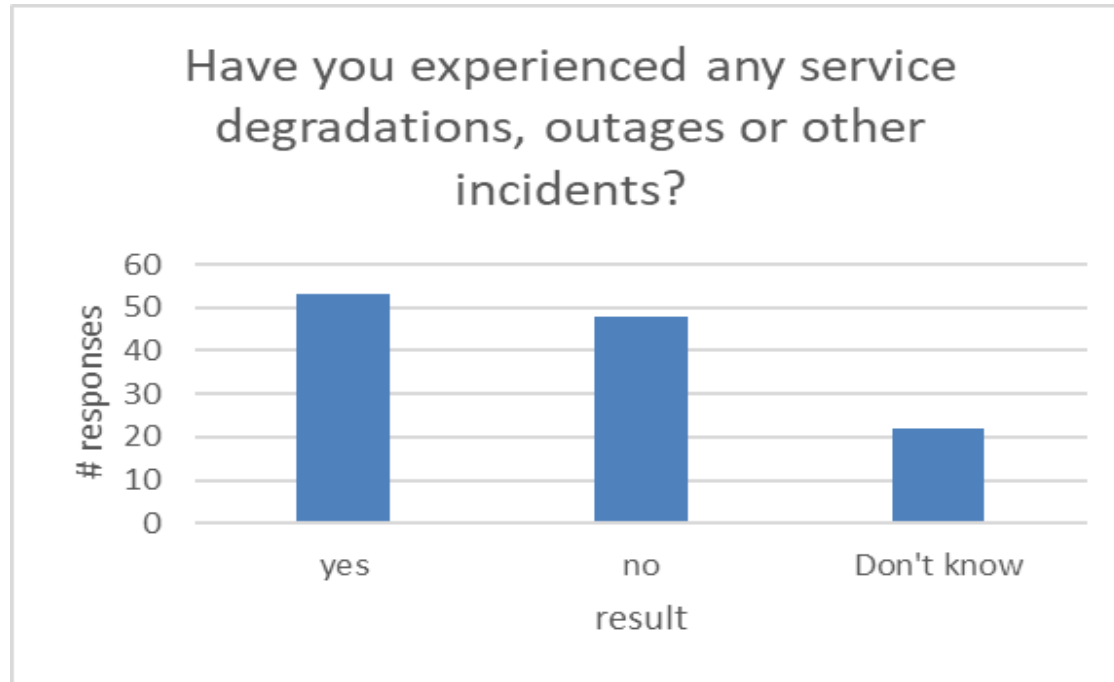
- 91% of all respondents find the GLA system useful.
- Consistent response across the user breakdown.

GLA DGPS performance



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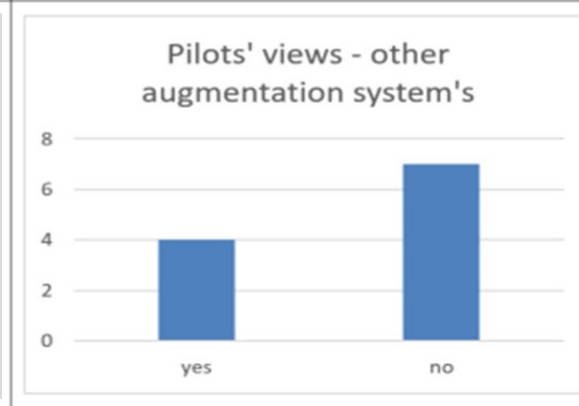
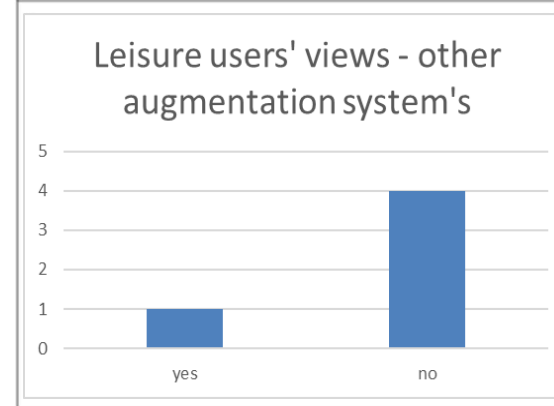
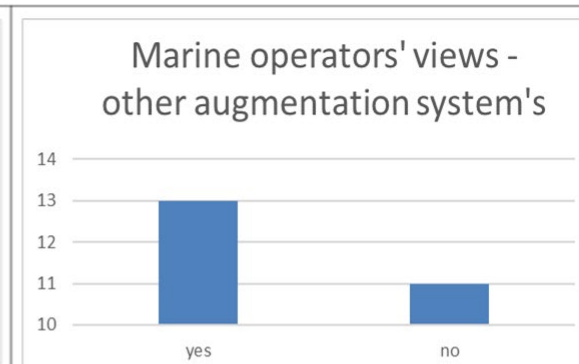
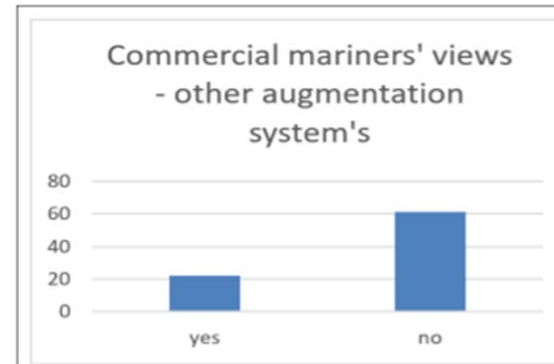
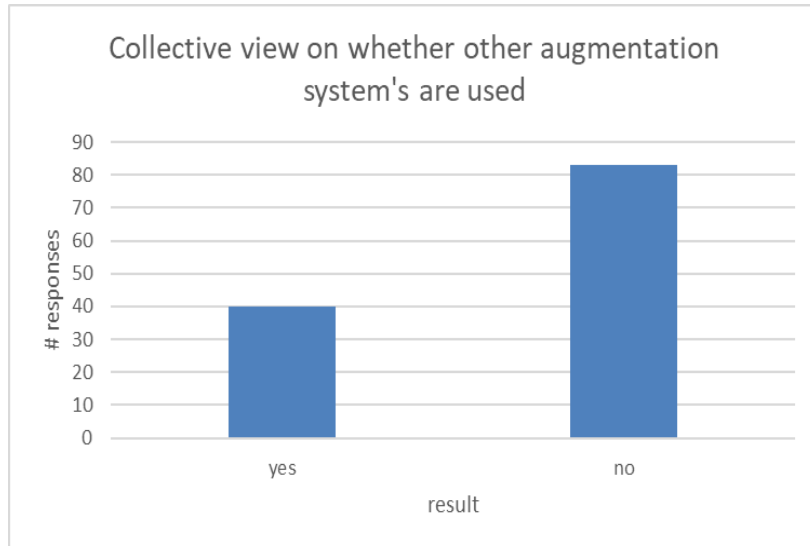
- The majority of user have experienced service degradations, but GLA generally don't hear about them. Perhaps:
 - mariner's don't know who to tell or how?
 - interruptions or outages are short enough to not be a problem?
- What does this mean for continuity?

Alternative systems



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- The majority of users do not use alternative systems.
- Alternatives include EGNOS and WAAS, along with commercial systems.
- Marine operators do use alternatives, perhaps linked to DP or specific operations

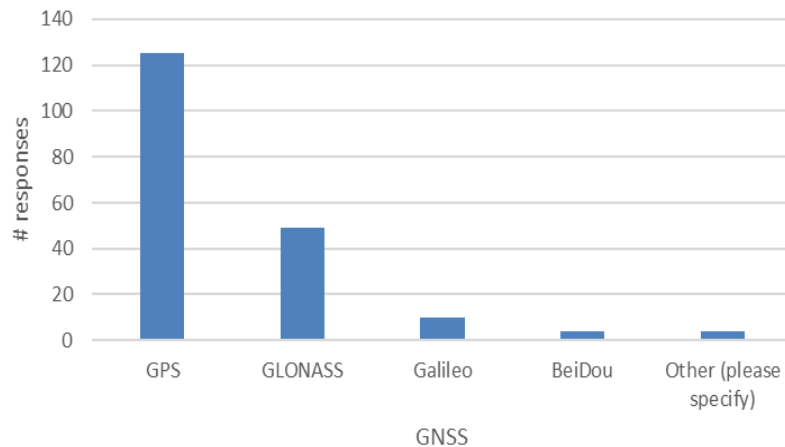
GNSS in use today



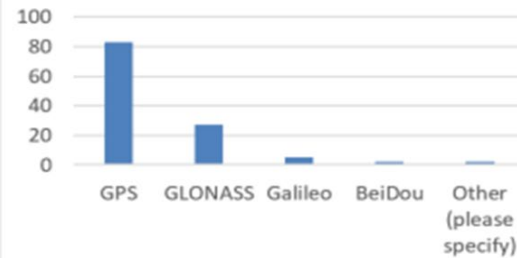
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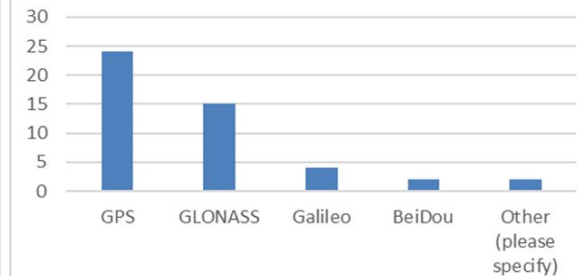
Collective views of which GNSS are used today



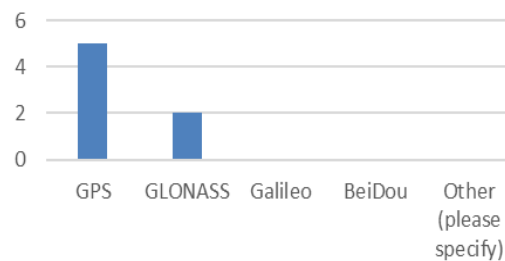
Commercial mariners' views on which GNSS are used today



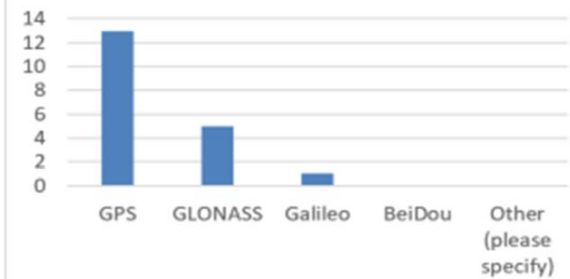
Marine operators' views of which GNSS are used today



Leisure users' views on which GNSS are used today



Pilots' views of which GNSS are used today



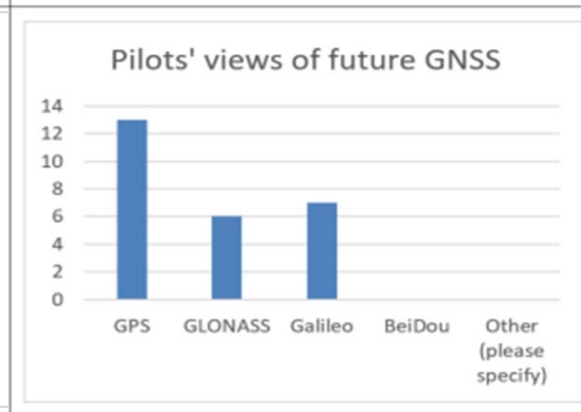
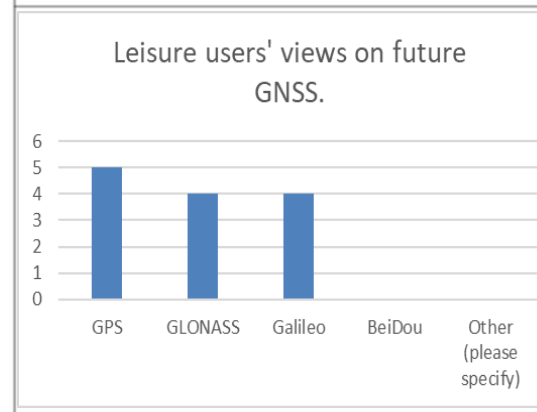
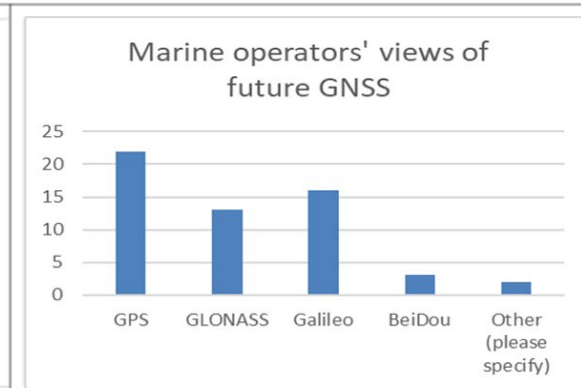
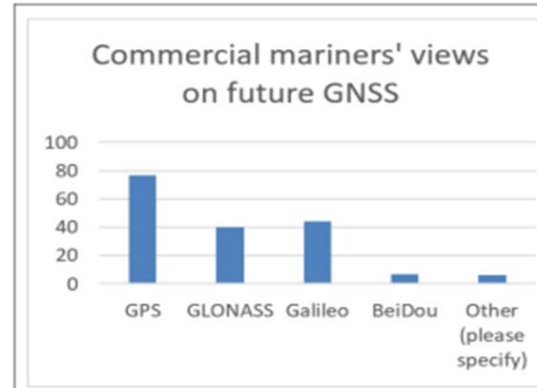
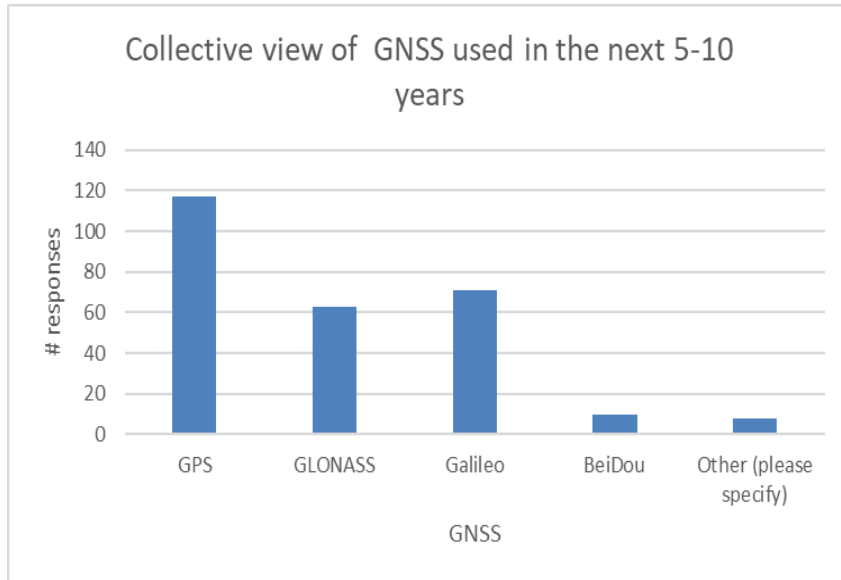
- GPS is the most widely used GNSS today
- GLONASS and Galileo also used to varying degree.
- BeiDou use seems quite low, possibly due to lack of awareness.

Future GNSS



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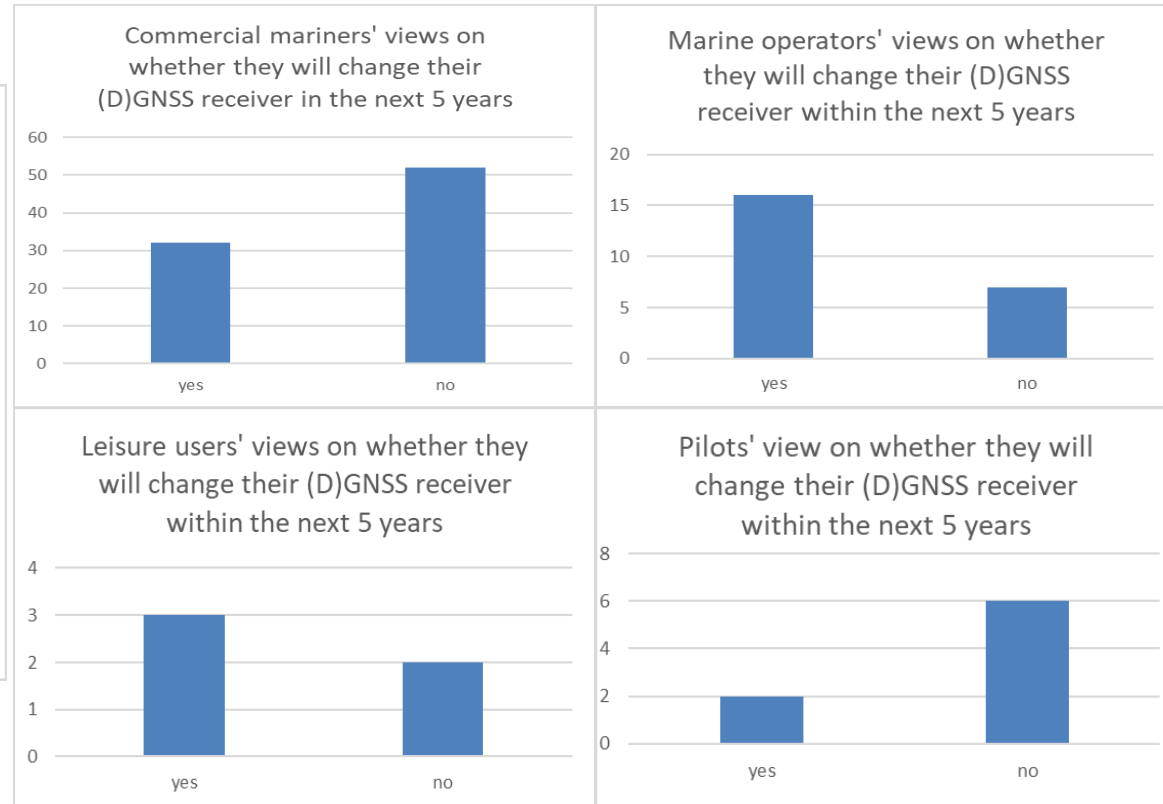
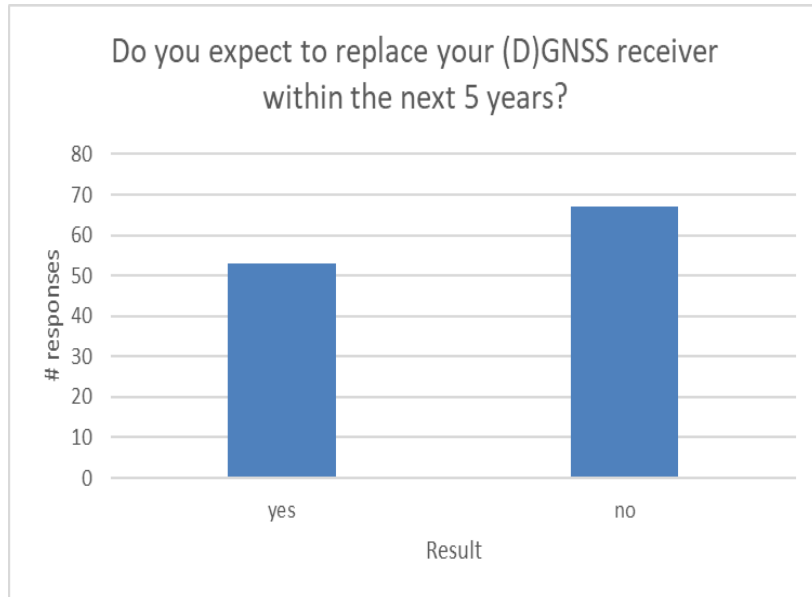
- Future GNSS is more multi-constellation, using GPS, GLONASS and Galileo
- Once more BeiDou use seems quite low.

Receiver changes



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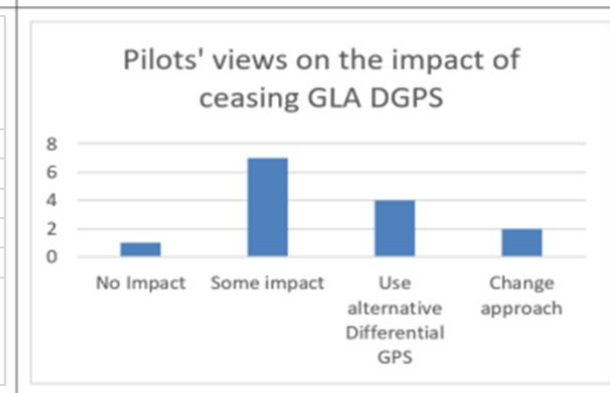
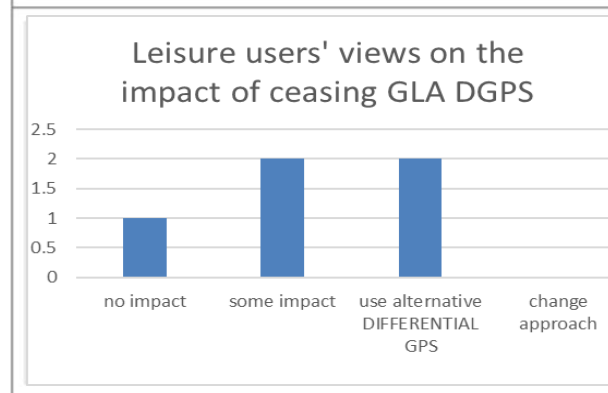
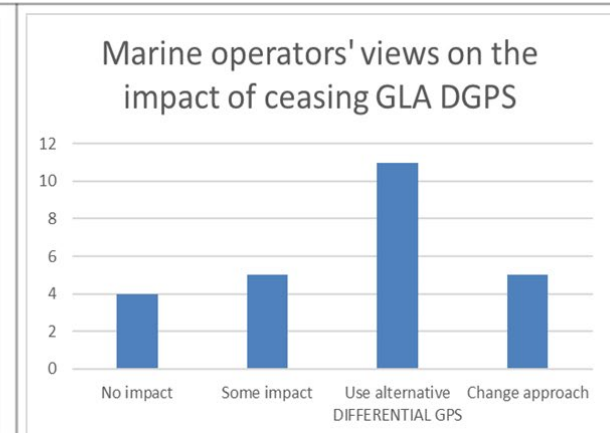
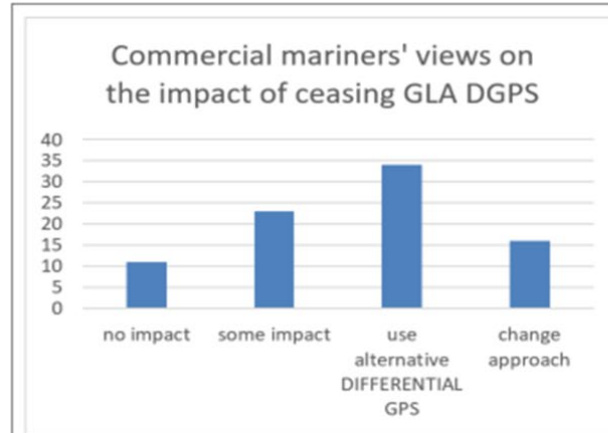
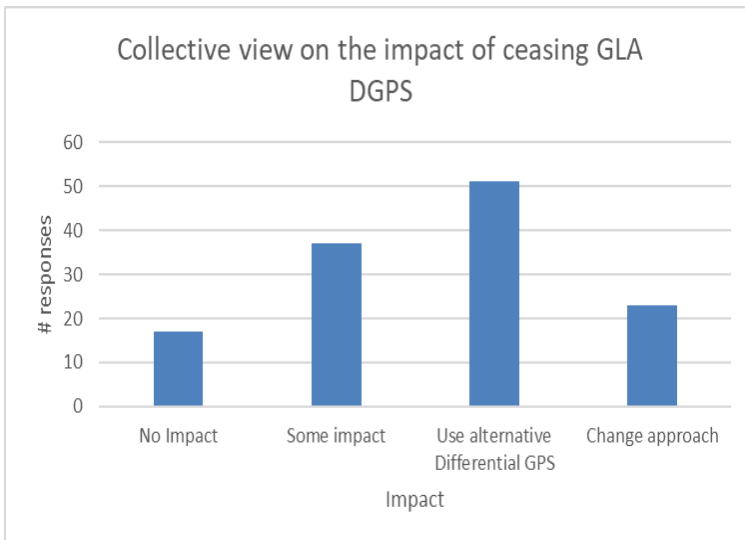
Overall, most mariners do not expect to change their receiver within the next 5 years. It's recognised that some mariners are unsighted on equipment changes.

Closure of GLA DGPS



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Survey summary

User base

- Of the 153 responses received, the vast majority were from mariners representing a wide range of vessels and user groups.
- GLA DGPS system is being used by some farmers, manufacturers and academics, but not utility companies.

Current use

- 91% of mariners find the GLA Differential GPS service useful, with the vast majority (70%) of users reporting that both the integrity and accuracy improvements are considered important.
- There was a wide range of views in terms of which operations required DGPS or not. Overall, DGPS is considered
 - *critical* for pilotage, dynamic positioning and surveying operations.
 - *nice to have* for general navigation, monitoring of position, and for a passenger ship standing off points of interest.
 - *not required* for commercial fishing.

It is considered critical for some specialised users, such as pilots and defence/security users.

- 78% of users report receiving integrity alerts from their DGPS receiver.
- 31% of users report using additional DGPS services (EGNOS and commercial services)
- 96% of respondents use GPS today, with around 38% also using GLONASS and 8% using Galileo, indicating a potential ratio of 60:40 for GPS only and multi-constellation receivers currently in use.
- The GLA system is held in high regard.

Survey summary

Future requirements

- Over the next 5-10 years, mariners' expect to use a mixture of GNSS suggesting a move towards a multi-constellation over time.
- Most users will look to use GPS, GLONASS and Galileo in the main. This may indicate a lack of awareness regarding the BeiDou constellation.
- Most mariners do not expect to change their current receiver technology over the next 5 years, which indicates that the majority GNSS receiver changes will take place in years 5-10.

Impact if discontinued

When considering the impact to their operations if the GLA service was discontinued:

- 13% of users reported they would not be impacted
- 28% reported some impact to their operations.
- 39% reported that they would need to find an alternative source of differential corrections.
- 18% reported that they would have to change their approach.
- 2% skipped the question

Face-to-face discussions



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Discussion with:

- 26 vessel crews
- 1 nautical college class
- 1 lead pilot/deputy harbour master

Dublin & Howth ports

Montrose port

Grangemouth port

Felixstowe & Harwich ports

Maritime college



Face-to-face summary



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- All considered it a useful service; some felt it was critical while for others it was a nice to have. Some users consider it a good crosscheck with other navigation data, while others rely on it for integrity alarms. Some interviewees reported that DGPS is important to support pilotage and berthing operations, especially in narrow waterways and in periods of low visibility. They all appreciated the service.
- The majority of interviewees stated that whilst they would prefer DGPS to remain operational they could still navigate safely/continue their operations if transmissions ceased. A number of interviewees stated they would feel uncomfortable if the GLA DGPS service was discontinued.
- A number stated that they considered DGPS to be something working in the background automatically and several stated they only thought about DGPS when they received an alarm from their unit. It would seem that DGPS is not conspicuous enough or critical for some interviewees to be aware of it, or conscious of how it is being used. This could be read that the system is simply working very well and managing integrity without alerting the mariner, or it could be that the unit is muted/switched off. Comments received from one respondent referred to training being focused on how to use the service, rather than what it does or why it is there.

Face-to-face summary



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- It seems from the discussions that the GLA DGPS system is not generally useful to fishermen.
- The vast majority of interviewees expect to continue to use GPS on its own, although some do consider using other constellations in time.
- All the vessels visited in Felixstowe were fitted with Receiver Autonomous Integrity Monitoring (RAIM) enabled receivers.
- One vessel visited had two maritime receivers configured to use EGNOS corrections in addition to RAIM, effectively applying two integrity checks. The vessel crew reported that they were quite happy with the performance received, although they originally thought they were using the GLA DGPS system.
- Crews do not know when the receivers on their vessels will be changed.

Overall, it is clear that there is a perceived benefit from using the GLA DGPS system from the point of reassurance and integrity. It would seem that most users expect to use only GPS in the near term and any cessation of the service would not prevent the vessel from operating, although other means of reassurance (integrity) would likely be required.