

<b>Title:</b> Competent PRS Authority <b>IA No:</b> UKSA001  <b>RPC Reference No:</b> <b>Lead department or agency:</b> UK Space Agency <b>Other departments or agencies:</b>	<b>Impact Assessment (IA)</b>			
	<b>Date:</b> 07/03/2017			
	<b>Stage:</b> Final			
	<b>Source of intervention:</b> EU			
	<b>Type of measure:</b> Secondary legislation			
<b>Contact for enquiries:</b> alex.leudar@ukspaceagency.bis.gsi.gov.uk				
<b>Summary: Intervention and Options</b>			<b>RPC Opinion: Not Applicable</b>	

Cost of Preferred (or more likely) Option				
Total Net Present Value	Business Net Present Value	Net cost to business per year (EANDCB in 2014 prices)	One-In, Three-Out	Business Impact Target Status
£47m	NQ	NQ	Not in scope	Not a regulatory provision

**What is the problem under consideration? Why is government intervention necessary?**

Galileo, the satellite navigation system currently being built by the European Union and the European Space Agency, will offer a number of services, one of which will be the Public Regulated Service (PRS). PRS will be restricted to government-authorized users. [Under European law the government must intervene by creating a Competent PRS Authority (CPA) to authorise and monitor the use and manufacture of PRS technology. Without setting up a CPA the UK may not access PRS, nor may UK manufacturers produce PRS technology according to the provisions of Decision 1104/2011/EU. This would have major consequences for defence and security as both the US and many European militaries plan to use PRS alongside military GPS. PRS can also equip blue light services and critical infrastructure operators who rely on satellite navigation with increased resilience. Industrially, losing access to PRS for UK manufacturers would mean the loss of potentially sizeable new markets.

**What are the policy objectives and the intended effects?**

The objective of the policy is to create the authorisation capability for PRS use and for PRS technology manufacture in the UK as well as to create a monitoring and enforcement capability to ensure compliance with PRS common minimum standards among PRS users and PRS technology manufacturers. The CPA should be set up at the lowest possible cost in such a way as allows it to effectively and reliably delivers the functions required of it. It is intended that the policy would place UK PRS technology manufacturers in the best possible position to participate in the emerging market for that technology and would ensure that potential PRS users have reliable and secure access to PRS signal.

**What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)**

Option 1: Do nothing – This option precludes the use or manufacture of PRS technology.  
Option 2: New government body – CPA is established as a new entity with all functions carried out in-house  
Option 3: De minimis approach – CPA functions are outsourced to the CPA of another Member State as long as they don't conflict with national sovereignty such as supporting sensitive activities (eg military). This option represents a loss of sovereignty as UK users and manufacturers would need to submit to regulatory oversight and enforcement by the Authority of another country.  
Option 4 (Preferred Option): Federated approach – Most CPA technical functions are allocated to Other Government Departments (OGDs), requiring high levels of dependence on organisations like GCHQ. This is not the cheapest option but strikes the best balance between security and sustainable delivery.  
Option 5: Amalgamated approach – key CPA functions including core technical skills are held within the UK Space Agency. The most security sensitive elements are allocated to other OGDs such as GCHQ.

<b>Will the policy be reviewed?</b> It will be reviewed. <b>If applicable, set review date:</b> Month/Year				
Does implementation go beyond minimum EU requirements?			No	
Are any of these organisations in scope?			<b>Micro</b> Yes	<b>Small</b> Yes
			<b>Medium</b> Yes	<b>Large</b> Yes
What is the CO <sub>2</sub> equivalent change in greenhouse gas emissions? (Million tonnes CO <sub>2</sub> equivalent)			<b>Traded:</b> N/ A	<b>Non-traded:</b> N/ A

***I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.***

Signed by the responsible SELECT SIGNATORY: Sam Gyimah Date: 20/02/2018

# Summary: Analysis & Evidence

# Policy Option 2

**Description:** New Government Body

## FULL ECONOMIC ASSESSMENT

Price Base Year 2016/ 17	PV Base Year 2016/ 17	Time Period Years 13	<b>Net Benefit (Present Value (PV)) (£m)</b>		
			<b>Low:</b> Optional	<b>High:</b> Optional	<b>Best Estimate:</b> £47.5m

<b>COSTS (£m)</b>	<b>Total Transition (Constant Price) Years</b>		<b>Average Annual (excl. Transition) (Constant Price)</b>	<b>Total Cost (Present Value)</b>
<b>Low</b>	£5.5m	13	£0.6m	<b>£13.1m</b>
<b>High</b>	£10.5m		£0.7m	<b>£19.7m</b>
<b>Best Estimate</b>	£8m		£0.7m	<b>£16.4m</b>

### Description and scale of key monetised costs by 'main affected groups'

All costs reported are costs to government, whereby the government would pay for establishment and running costs of a CPA. The costs are front loaded with almost 50% of the (Best Estimate) costs predicted to be transition costs, to fund infrastructure. The relatively low annual costs cover areas such as labour costs and providing key CPA services. Any costs to businesses have not been quantified due to a lack of information on the criteria for granting access to Public Regulated Service (PRS), though any costs would be indirect and engaging in PRS would be net beneficial.

### Other key non-monetised costs by 'main affected groups'

N/ A

<b>BENEFITS (£m)</b>	<b>Total Transition (Constant Price) Years</b>		<b>Average Annual (excl. Transition) (Constant Price)</b>	<b>Total Benefit (Present Value)</b>
<b>Low</b>	£0m	10	£3.6m	<b>£36.1m</b>
<b>High</b>	£0m		£10.1m	<b>£101.1m</b>
<b>Best Estimate</b>	£0m		£6.4m	<b>£64m</b>

### Description and scale of key monetised benefits by 'main affected groups'

The establishment of a CPA will have two main sets of benefits: PRS users and PRS manufacturers. PRS users will benefit from being able to use PRS either as a user or to develop applications to use PRS. PRS manufacturers will be granted the right to produce PRS receivers and security modules for the domestic market or for export, which has been valued at £50m p.a. All options are expected to have the same magnitude of benefits because benefits are derived from PRS not the CPA itself; the CPA merely enables these benefits.

### Other key non-monetised benefits by 'main affected groups'

In addition, military hardware exporters would benefit from the use of PRS in their equipment. The MOD has estimated between £1bn and £7.7bn p.a. of military exports are dependent upon the right to export PRS equipment. While the MOD cannot be certain on the true value of military exports dependent upon PRS equipment, it should be borne in mind that although not attributable, if 0.3% of £7.7bn of military hardware was saved for one year, this would entirely offset the estimated cost of the CPA over the entire appraisal period (10 years).

### Key assumptions/sensitivities/risks

**Discount rate (%)** 3.5

We make few option-specific assumptions here but the key assumption is that PRS user demand grows as expected. A key risk is that under option 2 the UK CPA would have to source very specialist skills which may not be practical and risks the deliverability of the whole CPA.

## BUSINESS ASSESSMENT (Option 2)

<b>Direct impact on business (Equivalent Annual) £m:</b>			<b>Score for Business Impact Target (qualifying provisions only) £m:</b>
<b>Costs:</b> NQ	<b>Benefits:</b> NQ	<b>Net:</b> NQ	
			N/ A

# Summary: Analysis & Evidence

# Policy Option 3

**Description:** De Minimis Approach

## FULL ECONOMIC ASSESSMENT

Price Base Year 2016/ 17	PV Base Year 2016/ 17	Time Period Years <b>13</b>	<b>Net Benefit (Present Value (PV)) (£m)</b>		
			<b>Low:</b> Optional	<b>High:</b> Optional	<b>Best Estimate:</b> £47.5m

<b>COSTS (£m)</b>	<b>Total Transition (Constant Price) Years</b>		<b>Average Annual (excl. Transition) (Constant Price)</b>	<b>Total Cost (Present Value)</b>
<b>Low</b>	£5.5m	13	£0.6m	<b>£12.8m</b>
<b>High</b>	£10.5m		£0.8m	<b>£20.2m</b>
<b>Best Estimate</b>	£8m		£0.7m	<b>£16.5m</b>

### Description and scale of key monetised costs by 'main affected groups'

As for option 2 all reported costs are government costs with insufficient information to estimate business costs. The key difference here is that we have assumed CPA functions, which are supplied by a foreign CPA, have the same cost as option 2, with an additional mark-up of 25%. This assumes that a foreign CPA would want a reward for using their public resources to perform a UK service.

### Other key non-monetised costs by 'main affected groups'

N/ A

<b>BENEFITS (£m)</b>	<b>Total Transition (Constant Price) Years</b>		<b>Average Annual (excl. Transition) (Constant Price)</b>	<b>Total Benefit (Present Value)</b>
<b>Low</b>	£0m	10	£3.6m	<b>£36.1m</b>
<b>High</b>	£0m		£10.1m	<b>£101.1m</b>
<b>Best Estimate</b>	£0m		£6.4m	<b>£64m</b>

### Description and scale of key monetised benefits by 'main affected groups'

The establishment of a CPA will have two main sets of benefits: PRS users and PRS manufacturers. PRS users will benefit from being able to use PRS either as a user or to develop applications to use PRS. PRS manufacturers will be granted the right to produce PRS receivers and security modules for the domestic market or for export, which has been valued at £50m p.a. All options are expected to have the same magnitude of benefits because benefits are derived from PRS not the CPA itself, the CPA merely enables these benefits.

### Other key non-monetised benefits by 'main affected groups'

In addition, military hardware exporters would benefit from the use of PRS in their equipment. The MOD has estimated between £1bn and £7.7bn p.a. of military exports is dependent upon the right to export PRS equipment. While the MOD cannot be certain on the true value of military exports dependent upon PRS equipment, it should be borne in mind that although not attributable if 0.3% of £7.7bn of military hardware was saved for one year, this would entirely offset the estimated cost of the CPA over the entire appraisal period (10 years).

Key assumptions/sensitivities/risks

**Discount rate (%)** 3.5

The key different assumption here relative to option 2 is that a foreign CPA will be selected to run some UK CPA functions and it will charge a mark-up of 25% over cost. This makes option 3 marginally more expensive than option 2 for performing the same tasks.

## BUSINESS ASSESSMENT (Option 3)

<b>Direct impact on business (Equivalent Annual) £m:</b>			<b>Score for Business Impact Target (qualifying provisions only) £m:</b>
<b>Costs:</b> NQ	<b>Benefits:</b> NQ	<b>Net:</b> NQ	
			N/ A

# Summary: Analysis & Evidence

# Policy Option 4

Description: Federated Approach

## FULL ECONOMIC ASSESSMENT

Price Base Year 2016/ 17	PV Base Year 2016/ 17	Time Period Years 13	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	High: Optional	Best Estimate: £47.2m

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	£5.5m	13	£12.8m
High	£10.5m		£19.8m
Best Estimate	£8m		£16.7m

### Description and scale of key monetised costs by 'main affected groups'

Option 4 follows the same approach as option 3, with the exception of a different mark-up over cost. While we assume the foreign CPA charges a mark-up over cost, here we assume that due to co-ordination issues each CPA task requires 10% more labour time. This is reflected in a higher estimated cost of £0.3m over the thirteen year appraisal period. However, the extra cost can be justified by leveraging existing technical skills in government, which may not be possible to source directly for the CPA.

### Other key non-monetised costs by 'main affected groups'

N/ A

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	£0m	10	£36.1m
High	£0m		£101.1m
Best Estimate	£0m		£64m

### Description and scale of key monetised benefits by 'main affected groups'

The establishment of a CPA will have two main sets of benefits: PRS users and PRS manufacturers. PRS users will benefit from being able to use PRS either as a user or to develop applications to use PRS. PRS manufacturers will be granted the right to produce PRS receivers and security modules for the domestic market or for export, which has been valued at £50m p.a. All options are expected to have the same magnitude of benefits because benefits are derived from PRS not the CPA itself; the CPA merely enables these benefits.

### Other key non-monetised benefits by 'main affected groups'

In addition, military hardware exporters would benefit from the use of PRS in their equipment. The MOD has estimated between £1bn and £7.7bn p.a. of military exports is dependent upon the right to export PRS equipment. While the MOD cannot be certain on the true value of military exports dependent upon PRS equipment, it should be borne in mind that although not attributable if 0.3% of £7.7bn of military hardware was saved for one year, this would entirely offset the estimated cost of the CPA over the entire appraisal period (10 years).

Key assumptions/sensitivities/risks

Discount rate (%) 3.5

Under option 4 we make an additional assumption that externally allocating work is a slower and more laborious task. We assume that this translates into each CPA function requiring 10% more labour time.

## BUSINESS ASSESSMENT (Option 4)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: NQ	Benefits: NQ	Net: NQ	
			N/ A

# Summary: Analysis & Evidence

# Policy Option 5

Description: Amalgamated Approach

## FULL ECONOMIC ASSESSMENT

Price Base Year 2016/ 17	PV Base Year 2016/ 17	Time Period Years <b>13</b>	<b>Net Benefit (Present Value (PV)) (£m)</b>		
			<b>Low:</b> Optional	<b>High:</b> Optional	<b>Best Estimate:</b> £47.3m

<b>COSTS (£m)</b>	<b>Total Transition (Constant Price) Years</b>		<b>Average Annual (excl. Transition) (Constant Price)</b>	<b>Total Cost (Present Value)</b>
<b>Low</b>	£5.5m	13	£0.6m	<b>£13.1m</b>
<b>High</b>	£10.5m		£0.7m	<b>£20.1m</b>
<b>Best Estimate</b>	£8m		£0.7m	<b>£16.6m</b>

### Description and scale of key monetised costs by 'main affected groups'

Finally, option 5 is similar to option 4 just with less CPA functions performed by other government departments such as GCHQ. We again apply the 10% labour time mark-up for CPA functions performed by other government departments, which again leads to costs of £17m, £0.3m more than options 2 and 3. However, option 5 like option 4 allows the CPA to leverage existing skills in government, which otherwise would be very difficult to source.

### Other key non-monetised costs by 'main affected groups'

N/ A

<b>BENEFITS (£m)</b>	<b>Total Transition (Constant Price) Years</b>		<b>Average Annual (excl. Transition) (Constant Price)</b>	<b>Total Benefit (Present Value)</b>
<b>Low</b>	£0m	10	£3.6m	<b>£36.1m</b>
<b>High</b>	£0m		£10.1m	<b>£101.1m</b>
<b>Best Estimate</b>	£0m		£6.4m	<b>£64m</b>

### Description and scale of key monetised benefits by 'main affected groups'

The establishment of a CPA will have two main sets of benefits: PRS users and PRS manufacturers. PRS users will benefit from being able to use PRS either as a user or to develop applications to use PRS. PRS manufacturers will be granted the right to produce PRS receivers and security modules for the domestic market or for export, which has been valued at £50m p.a. All options are expected to have the same magnitude of benefits because benefits are derived from PRS not the CPA itself; the CPA merely enables these benefits.

### Other key non-monetised benefits by 'main affected groups'

In addition, military hardware exporters would benefit from the use of PRS in their equipment. The MOD has estimated between £1bn and £7.7bn p.a. of military exports is dependent upon the right to export PRS equipment. While the MOD cannot be certain on the true value of military exports dependent upon PRS equipment, it should be borne in mind that although not attributable if 0.3% of £7.7bn of military hardware was saved for one year, this would entirely offset the estimated cost of the CPA over the entire appraisal period (10 years).

Key assumptions/sensitivities/risks

**Discount rate (%)** 3.5

Under option 5 we make an additional assumption that externally allocating work is a slower and more laborious task. We assume that this translates into most CPA functions requiring 10% more labour time.

## BUSINESS ASSESSMENT (Option 5)

<b>Direct impact on business (Equivalent Annual) £m:</b>			<b>Score for Business Impact Target (qualifying provisions only) £m:</b>
<b>Costs:</b> NQ	<b>Benefits:</b> NQ	<b>Net:</b> NQ	
			N/ A

# Evidence Base (for summary sheets)

## *Public Regulated Service (PRS)*

### **Background**

1. Galileo is a satellite navigation system currently being built by the European Union (EU) in collaboration with the European Space Agency<sup>1</sup> (ESA). The most mature of these systems is still the US GPS system. Although unlikely, this could technically become unavailable in times of crisis or conflict (along with the Russian Glonass and Chinese Compass systems). Galileo differs from other satellite navigation systems in that it is conceived as a civil system under civil control, unlike others whose primary function is military.
2. One of the services which Galileo offers is the ‘public regulated service’ (PRS). The PRS signal will be restricted to government-authorized users, and used for sensitive applications which require a high level of service continuity. Other Galileo services include an Open Signal, available without charge for use by anyone with appropriate mass-market equipment, a Commercial Service which will be chargeable to users and a Search & Rescue Service which adds functionality to existing satellite based Search & Rescue Capability.
3. Once PRS becomes available there are a number of users for whom it would potentially be useful. These include emergency services, defence and critical national infrastructure. The key advantage offered by PRS over conventional free-to-air “open” services is better resilience due to the highly encrypted, authenticated signal. This offers some protection against spoofing<sup>2</sup>, and would allow PRS users to continue to operate in the event that the Open Signal was unavailable.
4. PRS users will need to acquire PRS technology from manufacturers, whom are granted licences by the Competent PRS Authority (CPA<sup>3</sup>). It should be noted that the need for PRS users to acquire technology is **not a regulatory burden** but merely a technological necessity to access the signal.
5. It should be noted that following the decision to leave the EU, the rationale for proceeding with this SI, which takes powers to fully oversee PRS related activity, has been scrutinised by the Department for Exiting the European Union (DExEU), with a clear recommendation that until such time as the UK decides that it wants to withdraw from the Galileo programme, we should continue to work to lay these Regulations to ensure that UK industry has the best possible competitive advantage in exploiting this unique EU capability. To halt the Regulations now would be to send the signal that the UK has already called into question the value of the programmes. The UK will not be gold-plating this EU decision.

### *Competent PRS Authority*

6. The way in which Member States (MSs) access PRS is set out in Decision No 1104/2011/EU and is the subject of this Impact Assessment<sup>4</sup>. The Decision states that any MS wishing to use the PRS will need to designate a “Competent PRS Authority” (CPA) which will manage and monitor the manufacture, ownership and use of PRS receivers by natural persons living on the territory of that Member State and legal persons established on the territory of the Member State.
7. The functions legally required of a Competent PRS Authority are detailed in full in Articles 5(4) and 5(5) of Decision 1104/2011/EU, as outlined in Annex B, with the key responsibilities highlighted below:

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<sup>1</sup> It should be noted that the European Space Agency is entirely independent of the European Union.

<sup>2</sup> With spoofing, an adversary provides fake satellite navigation signals. This convinces the signal receiver that it is located in the wrong place and/or time.

<sup>3</sup> A Competent Authority is the descriptor used for the national entity designated as being responsible for regulatory oversight of the activity

<sup>4</sup> This Impact Assessment seeks to address whether the UK should set up a Competent PRS Authority in order for users to gain authorisation and access to the PRS signal and for manufacturers to develop and build PRS technology and if so, what form the CPA should take. Decision No 1104/2011/EU of the European Parliament and of the Council of 25 October 2011 on the rules for access to the public regulated service provided by the global navigation satellite system established under the Galileo programme.

- a. EU member states have the right to choose which legal persons residing in their territory can use PRS.
  - b. EU member states are responsible for ensuring the security of classified information in line with 001/844/EC, ECSC, Euratom and by Decision 2011/292/EU.
  - c. EU member states are responsible for the security of PRS technology.
8. A CPA has a wide breadth of responsibility, some pertaining to the authorisation and monitoring of PRS users and some pertaining to authorisation and monitoring of the manufacturers of PRS technology. The CPA's main duties as defined in EC 1104 are highlighted below:
- a. License users of PRS technology, manufacturers of PRS technology, developers of PRS technology, owners of PRS technology, exporters of PRS technology and the transfer of PRS technology to another EU MS and that licencees handle classified PRS information appropriately
  - b. Monitor compliance with and enforce licence conditions
  - c. Provide encryption keys to access PRS
  - d. Ensure the security of PRS equipment and PRS information.
9. In order to build a clear picture of what the functions of a CPA entail and to provide background on what the costs of serving those functions might be, the practicalities surrounding the use and manufacture of PRS technology are detailed below.

## PRS technology users

### *Potential PRS technology users*

10. PRS access is restricted to government-authorized users for sensitive applications which require effective access control and a high level of service continuity. The scope of what type of users can be granted access to PRS may be decided by Member States as Article 3(3) of Decision 1104/2011 states that "*each Member State which uses PRS shall decide independently which categories of natural persons residing on its territory or performing official duties abroad on behalf of that Member State and legal persons established on its territory are authorised to be PRS users, as well as the uses to which PRS may be put*".
11. A PRS Application Concept Involving Future Interested Customers (PACIFIC)<sup>5</sup> project involving 20 companies from more than 14 European countries was carried out in 2007/8 to scope the potential user base of PRS. PACIFIC identified and surveyed 200 user communities across the EU and Norway in several application areas. This study provided an initial insight to potential PRS user communities but would likely benefit from further development, not least to update it in line with current thinking. In addition, the Department for Transport conducted a report into the management of PRS and a joint CGI-QinetiQ report assessed the development of a CPA. Together these reports paint a picture of what functions the UK CPA will conduct.
12. The possible applications noted across MSs could include:
- **Law enforcement** (Police, Special Ops, Customs)
  - **Emergency Services** (Fire brigades, ambulances, civil protection)
  - **Defence** (Army, Marine, Air Force)
  - **Critical Telecom** (Network operators)

<sup>5</sup> <http://gsa.europa.eu/projects/pacific/www.prs-pacific.eu/index.html>



- **Critical Energy** (Energy suppliers)
- **Critical Transport** (Civil aviation)
- **Strategic Activities** (Commercial ports, space agencies).

13. Space and satellite services have been deemed Critical National Infrastructure (CNI) in the UK. PRS will play an important role in the provision of the essential services using satellite data.

*Selection of authorised PRS users in the UK*

14. The wider the umbrella of users is spread, the larger the potential uptake of of the service. This would enable more users to benefit from PRS, accelerate the proliferation of PRS technology and help to reduce the equipment unit cost. Insofar as the UK has a competitive advantage for supplying the UK market<sup>6</sup>, in developing PRS technology a wider user base could benefit UK manufacturing as well as demonstrate the range of PRS applications to other MSs.

15. On the other hand, the risk of PRS receivers being lost increases as the user base expands, which poses a threat to the security of the service for which the UK CPA is responsible under EU Decision 1104/2011/EU. Additionally, if the technology is intended to increase government resilience in times of crisis, then Government may prefer to be more selective in the way that it designates government-authorized users. A future policy decision will need to consider the costs and benefits of narrow versus wider use.

16. Early consultation with stakeholders (PRS technology manufacturers and potential users) indicates that the potential PRS user community should be defined in a way so as to best place UK PRS manufacturers in the emerging market for PRS technology, while ensuring the security of the service. The Ministry of Defence (MOD) has stated that although the US Global Positioning System will remain the standard for secure navigation systems, the MOD will enhance the resilience of military users and key domestic resilience responders by using new technologies incorporating the European Galileo system. In addition, the MOD has said that up to £7.7bn<sup>7</sup> of military exports will be reliant to some degree upon PRS access. It is likely that given the choice, prospective buyers will prefer military hardware with PRS and GPS receivers rather than hardware with just GPS receivers. This can be seen from the fact that over 95% of chip manufacturers for positioning systems already incorporate the Galileo system. The worldwide GNSS<sup>8</sup> market is large and growing with forecasts suggesting a global market worth €168bn per year by 2030,<sup>9</sup> with some estimates putting the UK share in the region of £6bn per year (compared to £1bn in 2012/13<sup>10</sup>).

17. Current UK Space Agency thinking is that PRS use could be authorised for a range of UK critical national infrastructure, namely the facilities, systems, sites and networks necessary for the delivery of the essential services upon which daily life in the UK depends. In some cases this may introduce ambiguity – eg where a commercial undertakes both commercial activities and functions where they act in lieu of Government (ie Serco or G4S undertaking prisoner transfers and collecting cash from shops which they deliver to banks. Where a prospective licensee undertakes such a breadth of activities it is likely that PRS access might be authorised based on whether a function is undertaken for commercial gain or whether an attack against the activity might be considered an attack against the State. When the UK consulted on this question, the consensus from respondents was that the UK

<sup>6</sup> This assumes that it will be less costly for UK firms to purchase PRS equipment from UK industry, due to factors such as transportation, language and currency exchange.

<sup>7</sup> Estimated by the MOD

<sup>8</sup> ‘Global Navigation Satellite System’ (such as GPS in the US, Galileo in EU, COMPASS in Russia and BEIDOU in China)

<sup>9</sup> GNSS Market Report, GSA, March 2015

<sup>10</sup> Industry predictions suggest the UK GNSS market could be worth over £6bn by 2030. The downstream element of this is assessed as being between 85-89%.

CPA should consider authorising a broad range of users whilst limiting the way in which PRS is used through licence conditions on a case by case basis.

18. A user-by-user approach may seem like a less clear process, which is potentially more costly. However, the UK is obligated under EU decision 1104/2011/EU to be responsible for ensuring the security of PRS equipment and information. In order to do this, it is likely that the UK CPA would draw up a set of requirements but it may also need to complete additional bespoke vetting to ensure the security of the system.

#### *How is PRS access granted?*

19. The Competent PRS Authority is responsible for processing requests for PRS access from potential users. A Competent PRS Authority is the interface between national user communities and the wider Galileo security infrastructure. In short, without a CPA, the benefits from PRS cannot be realised.
20. At the heart of the CPA is a classified server called a Point of Contact Platform (POC-P). The POC-P manages the encrypted keys for all PRS receivers under UK control – the. Associated with the POC-P is a POC-IS (Point of Contact Internal System). This POC-IS is the main set-up cost associated with establishing a CPA. The POC-P is classified SECRET which means that running one comes with significant running costs, including [?] the cost of maintaining a permanent communication link between the Galileo Security Monitoring Centre (GSMC) and the CPA. These are discussed in more detail in the Costs section below. Once the CPA becomes operational, government-authorized users would be able to obtain PRS receivers and technology which, along with their user keys, allow them to read the PRS signal.

#### *What is meant by PRS access rights?*

21. PRS access rights define the way in which a user or user group intends to use PRS satellite navigation services.
22. Any position obtained by satellite navigation is derived by receiving very precise timing signals from a number of satellites and using that data to calculate a position. This means that satellite navigation can provide:
- Accurate Positioning or location data
  - Accurate Navigation data (by drawing a line through a number of past positions to calculate speed and distance as well as a current position)
  - Accurate Timing data to a scale of 30 nanoseconds<sup>11</sup>.
23. This combination of Position, Navigation and Timing (PNT) means that PRS access is likely to be governed by the diverse needs of a range of user communities. Consequently, some users may be granted access rights to simply use the timing information (for time stamping purposes) whilst others may require access to positioning or navigation data. Some user communities may want to use the decrypted data remotely (e.g. to track assets from a central control room). Others may need the data presented directly on visual displays attached to the receivers themselves (as would be the case for a conventional satellite navigation unit). It is the responsibility of the CPA to define user access rights and to group users according to access rights.

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<sup>11</sup> One nanosecond equals one billionth of a second.

## *Do users pay for PRS access rights?*

24. A CPA will provide an interface between the user community and the wider Galileo security infrastructure. This means it will obtain encryption keys from the system and distribute them to authorised users. The question of whether users should be charged for this service requires careful consideration.
25. Each request to the Competent PRS Authority will incur a cost to the CPA and if the marginal benefit to the user is greater than this cost then objectively the PRS user should bear at least some of the cost of that transaction.
26. Early informal consultation with potential PRS users indicates that charging for PRS access would however severely limit PRS uptake, particularly in the early stages. Access to Open Service alternatives from either GPS or Galileo is free. Thus a charge for PRS use is likely to deter initial user uptake. It should also be considered that PRS is an embryonic technology, the benefits of which are subject to high uncertainty and thus may lower the perceived value that potential users place on access to the service.
27. If the UK wishes to accelerate the proliferation of PRS technology, then charging for access at the outset is not advised. There are two main arguments why the UK should wish to encourage early uptake of PRS. Firstly, the UK has made a strong commitment to the European Commission's Galileo programme through its wider contribution to the EU budget. To capitalise on investment in Galileo to date, PRS should be supported in its early stages of development. Secondly, UK industry has had a key involvement with the early stages of PRS technology development. The UK's high tech manufacturing capability and the strength of its space industry means that it has been highly successful in competing for key contracts that have been funded under the programme. It is poised to play a potentially pivotal role in a nascent market which has the potential to be extremely lucrative.
28. As PRS use becomes more widespread and its benefits become apparent, the potential for charging users for certain services could be considered. Ideally, this could help to ensure that the CPA could, in time, be operated on a cost-neutral basis. Indeed the formal consultation suggested that stakeholders would support a cost-neutral approach. However, the secondary legislation to establish the CPA [?] will not provide the power for the CPA to recover costs as Ministers decided in 2012 that it would be premature to do so. If a cost-neutral approach is deemed appropriate in future, a change to the proposed legislation will be required. In summary, at this time we do not propose charging a fee or pursuing regulation to enable this in future

## **PRS technology manufacturers**

### *Restrictions on the manufacture of PRS technology*

29. 'PRS technology' refers to PRS receivers and security modules. PRS technology manufacture is only permitted in a Member State which has designated a Competent PRS Authority. Paragraph 17 of Decision 1104/2011/EU states that "*with regard to receiver manufacturing and security, security requirements make it necessary for this task to be entrusted only to a Member State which has designated a competent PRS authority or to undertakings established on the territory of a Member State which has designated a competent PRS authority*". Thus, a CPA would have to be set up in the UK if UK manufacturers wished to participate in the market for PRS technology.
30. In addition, receiver manufacturers must be fully authorised by the Security Accreditation Board for European Global Navigation Satellite Systems (GNSS) and must comply with its decisions. CPAs will

continuously monitor compliance both with that authorisation requirement and those decisions. A CPA also monitors compliance with specific technical requirements stemming from the common minimum standards. (The extract from the Decision's Annex outlining the areas these will cover are listed in Annex B).

31. A manufacturer who is authorised to manufacture PRS technology in the UK may export (transfer) the technology to other MSs without restrictions. Should they wish to manufacture equipment for export outside the EU, export controls apply, as outlined in Decision 1104/2011/EU.

### *Market outlook for PRS technology*

32. The market for PRS depends on how the user community for PRS develops. As mentioned previously, PRS is an embryonic technology and questions remain surrounding the uptake of the service and the value it will be perceived to add for its eventual user community. The first PRS signals became available in 2010 for validation and testing in a simulated environment. Following the successful launch of the first two in-orbit validation (IOV) satellites in October 2011, PRS signals from orbiting satellites are now being received by a number of test receivers. A total of eighteen satellites have been launched into orbit to date with a further twelve satellites to be launched. Basic services are now available and the European Commission envisages PRS will become fully operational by the end of 2020.
33. Key factors that are likely to significantly influence how PRS is used and by whom, will include the "retail" price of receivers, the administrative overhead for user groups, any other obligations imposed on user communities through the common minimum standards (as outlined in Annex B), how MSs manage access at national level through their CPAs and whether any charges are applied by MSs for either access to or usage of the service, which the UK is not legislating to do.
34. UK Space's<sup>12</sup> PRS market estimates suggest that the UK would generate revenues of £50m per annum and, in addition, the MOD considers that PRS would enable military exports, which are worth in total £7.7bn per annum. to the UK economy, and over 80%<sup>13</sup> of this is the heavily GNSS dependent aerospace sector. Although the MOD cannot be certain on the precise value of exports which would be lost without access to PRS, even 10% of the total figure would represent lost revenues of £770m per year. Sophisticated military hardware often relies on very precise navigation and timing data. Without PRS access, UK hardware would likely become less competitive compared to European hardware, which could access the PRS signal.

### **Rationale**

35. The government should intervene due to regulatory failure. Decision 1104/2011/EU states that a Competent PRS Authority, authorising and monitoring the use and manufacture of PRS technology, must be created in order for a UK user to access PRS, or for UK manufacturers to make PRS technology. Under current UK legislation (or lack of it), UK firms would not be able to benefit from commercial opportunities in this area and potential PRS users in the UK, which could include critical national infrastructure, defence and emergency services, would not be able to derive benefit from the use of PRS.

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<sup>12</sup> UK Space is a trade association for the UK's space industry.

<sup>13</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/541330/20160727 - Official Statistics - UKTI DSO Core Slides for 2015 - Final Version.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/541330/20160727_-_Official_Statistics_-_UKTI_DSO_Core_Slides_for_2015_-_Final_Version.pdf)

36. The PRS is a service to which the general public will not have access. Its use will require oversight to ensure security is maintained. Moreover, certain applications of the service may be sensitive and the system itself comprises classified and protected technologies which must be controlled to prevent proliferation to unlicensed users which could undermine the system through misuse and abuse. It is therefore necessary to ensure users comply with clear standards which establish an authorisation procedure via the CPA and safeguard the use and storage of encryption keys, receivers and any other PRS related technology.

## Level of regulation

37. Under the proposed 'Public Regulated Services Regulations', which would allow the CPA to be fully established in the UK, the CPA will have the power to grant a licence to access PRS, manufacture, develop, use or export PRS equipment ; this is explained in more detail [?] below. The scope of these provisions is in line with EU Decision 1104/2011/EU whereby EU member states are required to establish a CPA and then may grant access to users based upon their own criteria.

*"The compliance authority may grant a licence to a person if the authority is satisfied that it is appropriate to do so having regard to the requirements of the PRS Decision, in particular Articles 3 to 5, 7 to 9, and 14 and the Annex."*

38. Once the regulations enter UK law it is likely that the UK CPA will draw up a list of requirements that will need to be met by X for a licence to be obtained. Under EU Decision 1104/2011/EU, the UK is responsible for ensuring classified PRS information and equipment remains secure. the [?] only feasible way of ensuring that the service remains secure and is usable by government for official communications is to have a set list of requirements.

## Policy objectives

### **i. To create the authorisation capability for PRS use in the UK**

- Government entities, organisations acting in lieu of government and critical national infrastructure have access to a resilient, authenticated GNSS signal even in times of crisis.

### **ii. To create the authorisation capability for PRS technology manufacture in the UK**

- UK manufacturers who have the technological capability and security clearance to manufacture PRS technology are able to access the market for PRS technology at an early stage.

### **iii. To create a monitoring and enforcement capability to ensure compliance with the common minimum standards among PRS users and PRS technology manufacturers**

- The use and manufacture of PRS technology does not compromise the security or the integrity of the service
- The penalty system applicable when the common minimum standards are infringed is effective, proportionate and dissuasive.

## Implications from leaving the EU

39. Galileo is an EU programme and access to PRS is granted to EU countries and some third countries and international organisations. In all cases, access is subject to establishing a CPA. Because it is an EU programme, once the UK leaves the EU it will not be automatically granted access to PRS, as this will have to be negotiated. In addition, the right to produce and export PRS security modules

and PRS receivers will need to be negotiated. For the purposes of this Impact Assessment we shall take the view that the UK maintains current PRS rights after leaving the EU, with any deviation from this position requiring a change in policy stance, which would require justification. The rationale for this is set out in paragraph 31 above.

40. The recent white paper published on 2<sup>nd</sup> February 2017 on the strategy for leaving the EU indicated a desire to remain within the Galileo programme:

*10.13 The UK has a proud history of leading and supporting cutting-edge research and innovation within the EU. We are an active participant in Horizon 2020, the EU's main funding instrument for collaboration on research and innovation. In addition, the UK has played a major part in developing the main EU space programmes, Galileo and Copernicus, which have supported the rapid growth of the UK space sector and contributed directly to our prosperity and security. The UK was a founding member of the European Space Agency, to which we recently committed €1.4 billion in cutting edge research and development over the next four years. The UK has also been a driving force behind European and international research on nuclear fusion.*

*10.14 As we exit the EU, we would welcome agreement to continue to collaborate with our European partners on major science, research and technology initiatives.*

## Options considered

41. If a CPA is set up, the question remains what form that body should take. Member States wishing to set up a CPA have autonomy in deciding its form. The ownership<sup>14</sup> of each Full Time Equivalent member of staff (FTE) is demonstrated in Table 12 in Annex A; five options, including a 'Do Nothing' option, have been identified.

### Option 1: Do nothing

42. Under this option, no Competent PRS Authority is set up. The UK does not designate a CPA in another Member State to undertake CPA activities. UK manufacturers are unable to manufacture PRS receivers and there can be no deployment of PRS technology to UK user communities.

43. Under the a point of contact to assist in reporting detected potentially harmful electromagnetic interference<sup>15</sup> affecting PRS must in any case be designated. This obligation is already being performed from within the UK Space Agency.

### Option 2: New government body

44. A Competent PRS Authority is established as a new entity with all the resource for undertaking every function of the CPA held in-house. In other words, all 18 CPA functions identified in Figure 1 in Annex A are performed by this new entity.

45. The new entity must be within government as the responsibilities of "Competent Authorities" rest directly with Member States". This rules out the creation of a non-departmental public body.

### Option 3: De minimis approach

46. Under this option, a Competent PRS Authority is set up which outsources some CPA functions to the CPA of another Member State in as much as those functions do not conflict with national sovereignty.

47. Many of the CPA functions will have to be performed within the UK either for sovereignty or practical reasons. Table 10 in Annex A shows the FTE savings from outsourcing to a foreign CPA. The UK would no longer perform the roles of security officer, operations team and equipment officer. A full list of the outsourced roles is shown in Table 9 in Annex A.

48. Where it would undermine national sovereignty or would be impractical for certain functions to be undertaken by another country, these functions could be fulfilled by a 'de minimis' UK CPA which could either be set up as an independent entity or accommodated within an existing government entity. This approach may prove difficult to establish, with the UK needing to source an appropriate foreign CPA and then set up a contract to ensure quality of service.

### Option 4: Federated approach

49. Under this option, the role of the Competent PRS Authority is held within part of an existing UK government entity which acts as co-ordinator to some of the functions of the CPA. These functions

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<sup>14</sup> Each CPA function is outlined Annex A figure will be provided by either: a UK CPA, another government department or a foreign CPA.

<sup>15</sup> Detection of potentially harmful electromagnetic interference refers to detection of jamming or spoofing devices.

would be delivered through partner organisations to leverage existing technical capabilities across other parts of government. The intention of this approach would be to deliver a comprehensive service at the lowest possible direct cost. However, it does rely on a government body willingly accepting the role of UK CPA.

50. An indication of what a federated organisation could look like is outlined in Table 10 in Annex A. The benefit of this approach is that it allows the UK CPA to leverage existing technical skills. These skills will otherwise not be readily available and it may not be plausible to source them directly for the CPA so unskilled individuals would otherwise require training. The downside is that increased points of contact may cause inefficiencies and require more labour time to complete CPA functions.
51. We assume that this causes increased workloads between 0% and 20% across each UK CPA function due to co-ordination issues. We believe the increase in workload will be no higher than 20% and in reality will probably be quite marginal. In the absence of additional information we assume that total labour time is 10% higher relative to Option 2. However the federated approach makes significant savings in both time and resource by not requiring recruitment into and training for technical roles.

Option 5: Amalgamated approach

52. This option is an amalgamation of Options 2 and 4. It retains “command and control” capability and key functions within part of an existing government entity whilst outsourcing the most security sensitive or less intensive elements to other government departments (OGDs).
53. Under this approach certain roles are held within a standalone CPA, while some specialist functions are held externally. Although, it could be argued that since only specialist functions are held by OGDs, total labour time is reduced. We assume the same logic as for Option 4 – that is that working across other government departments leads to inefficiencies across the CPA. However, the point should be stressed that sourcing resource for CPA functions externally could save significant costs in recruiting and training.

**Consultation**

54. In 2013 a consultation was carried out with five questions to understand the views of stakeholders on how the CPA should operate. In total there were nine respondents and each question, the feedback and the government response is set out below. Table 1 below summarises the questions.

Table 1: Summary of Consultation and Responses

Question	Summary of Responses
<p><b>What form should the government give to the Competent PRS Authority?</b></p> <p><b>(a) Do nothing – No CPA is set up in the UK. There are no UK users or UK manufacturers.</b></p> <p><b>(b) New Government body – CPA is established as a new entity and all functions are carried out in-house</b></p> <p><b>(c) De minimis – outsource as much as possible to the CPA of another Member State.</b></p> <p><b>(d) Federated approach – CPA based within existing government entity leveraging support</b></p>	<p><b>The consensus among respondents was support for the option (e), where a standalone CPA is created but utilises services from other government departments.</b></p>



<p>from across government.</p> <p><b>(e) Amalgamated approach combines benefits of (b) &amp; (d). “command &amp; control” and key functions accommodated in an existing government entity.</b></p>	
<p><b>Should the Government set up a Competent PRS Authority to:</b></p> <p><b>(a) authorise and oversee manufacturers and equip them with the regulatory framework to develop technology and sell it to user communities outside the UK?</b></p> <p><b>(b) authorise and oversee user communities to use the PRS AND to authorise and oversee manufacturers and equip them with the regulatory framework to develop technology and sell it to user communities in the UK and elsewhere?</b></p>	<p><b>The majority of respondents supported option (b) whereby the CPA authorises both users and manufacturers of PRS equipment.</b></p>
<p><b>If a Competent PRS Authority is set up to authorise and oversee both manufacturers and users, should that definition include:</b></p> <p><b>(a) Government entities only (including Emergency Services, Security Services, Boarder Authorities, Coastguard, Prison Services etc)?</b></p> <p><b>(b) As (a) plus entities acting in lieu of Government, i.e. private security firms who undertake prisoner transfers but also do other private work?</b></p> <p><b>(c) As (a) plus Critical National Infrastructure such as Critical Transport, Energy, Communications and others deemed to require access to resilience offered by PRS?</b></p> <p><b>(d) All the entities covered under (a), (b) and (c)?</b></p>	<p><b>The majority of respondents supported option (d), where the CPA authorises government entities, organisations working in lieu of government and critical national infrastructure.</b></p>
<p><b>Should penalties for infringing national provisions enacted pursuant to EU Decision 1104/2011:</b></p> <p><b>Follow the existing precedents for compliance and enforcement based on a collaborative stepped approach?</b></p> <p><b>Consider further penalties beyond a collaborative, stepped approach (if so please</b></p>	<p><b>All respondents supported a stepped approach to penalties.</b></p>

<p><b>describe what alternative penalty system you would consider for this function and why).</b></p>	
<p><b>Should government aim to operate the CPA on a cost-neutral basis via a future charging regime?</b></p> <p>(a) Yes</p> <p>(b) No</p> <p><b>If you answered yes above, should charges be levied on:</b></p> <p>(a) Manufacturers?</p> <p>(b) User communities?</p> <p>(c) Other countries or international organisations who may want to use UK CPA capabilities?</p>	<p><b>The CPA should operate on a cost neutral basis with costs levied on users and foreign customers.</b></p>

55. Overall, there was support for a standalone CPA, which utilises the support of other government departments that authorises users and manufacturers of PRS equipment to as broad a group of organisations as possible, while retaining a flexible approach to penalties and operating on a cost neutral basis.

56. It should be noted though that while the formal consultation supported Option 5, the consultation-stage impact assessment presented Option 5 as the lowest cost option and this may have impacted the choices of those consulted. This impact assessment takes account of new information and forms a different view of which options provides the best approach.

### Detailed costs and benefits

### Level of evidence collected

57. All the evidence required to accurately quantify the costs and benefits of the various options for the form of the Competent PRS Authority is difficult to fully gather at this stage given the embryonic nature of PRS technology. Were PRS technology already fully developed this would aid in giving an accurate indication of the costs of capability required (both in terms of staff and technical equipment) to deliver CPA functions. Similarly, some of the benefits to PRS users will only be revealed once the technology is up and running. A significant amount of work has been performed to establish the work, which the UK CPA will have to complete. However, the exact labour requirements will depend upon the demand of PRS, which will not become clear until PRS has established itself.

58. In estimating costs and benefits at this stage, an amount of informal consultation has occurred with OGDs, PRS industry stakeholders, PRS experts and the European GNSS Agency. In addition, a formal consultation has been undertaken to gauge stakeholders' opinions. The UK Space Agency has commissioned a report<sup>16</sup> looking into the functions of a UK CPA and how the CPA will operate.

59. Further evidence gathering was not deemed proportionate at this point due to uncertainty surrounding what the PRS system will look like. An informed comparison can be made between options with the evidence gathered as the *relative* cost of options becomes apparent. Some estimates are rough by necessity but have been made at this point to allow inter-option comparison.

<sup>16</sup> QinetiQ and CGI (2015), UK CPA Development

In addition, the scope of the CPA will be dependent upon negotiations in relation to the UK leaving the European Union, thus costs cannot be precisely calculated until negotiations are complete.

### **Identifying winners and losers**

60. The key stakeholders in this instance include the potential manufacturers of PRS technology and the potential users of PRS technology in the UK. The form that the CPA takes will largely impact on these two groups.

### **Effect on small businesses**

61. These regulations pose indirect costs and any business which engages with them will presumably expect to benefit.

### **One-in, Three-out**

62. This policy implements the EU Decision 1104/2011 which places it out of scope of 'One-in, Three-out'. The options considered to set up a Competent PRS Authority do not gold plate the Decision, i.e. they do not go beyond the minimum requirements of the Decision (see paragraphs 37 to 38 above). In addition, the measure does not impose any direct costs to business as the proposed legislation would not obligate any businesses to participate in the market for PRS.

### **Costs**

63. All costs have a bespoke scaling-up phase, which is directly linked to the timeline proposed in the UK CPA Development report by QinetiQ and CGI (see Figure 2, Annex A). The specific year in which infrastructure and FTEs are required has been informed by the timetable in Annex A and then modified through discussion with UK Space Agency policy experts.

64. We shall assess the costs and benefits over a ten year time horizon from the start of full PRS capabilities in 2020, as recommended in the better regulation framework manual<sup>17</sup>.

65. It should be borne in mind that the costs under each option represent a scenario where there has been significant activity in the UK domestic PRS market. This approach has been used to demonstrate a high government cost world with corresponding high UK benefits. However, if the PRS user market is slow to develop, the UK government will not need to develop a large CPA with expensive infrastructure. It is possible to manually provide encrypted keys, which would be feasible for a small community. Therefore, the costs presented here should be seen as conservative.

### **One-off set-up Costs**

66. If the UK is to hold a CPA it will require a secure server known as a POC-IS (point of contract-internal server) to allow for communication between the CPA and the wider Galileo infrastructure. The secure server will come at a cost and will need to be hosted within the UK under all scenarios with a direct communication link to a GSMC (Galileo Security Monitoring Centre). In addition to the cost of acquiring a secure server the UK will need a secure building to host the server within. It is

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<sup>17</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/468831/bis-13-1038-Better-regulation-framework-manual.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/468831/bis-13-1038-Better-regulation-framework-manual.pdf)

possible that an existing secure building exists where the server could be held but we shall assume that current suitable UK secure buildings are being used for other purposes and so the UK CPA would need its own secure facilities. Therefore, under all options the UK will need a POC-IS and a secure facility to host the server and hence the cost is identical.

67. Since the consultation-stage impact assessment conducted in 2012, little new information has arisen on either the costs of acquiring a POC-IS or the cost of a secure building. In the consultation-stage impact assessment the cost of a POC-IS was estimated at £1.025m with a range of £0.05m to £2m. UK Space Agency policy experts now believe this range has shrunk to £1m to £2m. It would seem appropriate, in the absence of additional information, to assume the cost is the mid-point in the range, as the consultation-stage IA did, which would be £1.5m.
68. The consultation-stage impact assessment estimated the secure infrastructure would cost between £0.5m and £1m, which was informed by industry sources and the Defence Science and Technology Laboratory. The current view by UK Space Agency, taking optimism bias into account, is that this is an underestimate with the true cost lying between £1m and £1.5m. As for the POC-IS we will estimate the cost of the secure infrastructure as being the midpoint of the range so in this case £1.25m.
69. In addition to the set up costs we assume the infrastructure depreciates over time and this represents a cost to the CPA. The POC-IS and the secure facility are fundamentally different and so we have assumed that the depreciation rates are different. While the POC-IS is a secure server and unlikely to have a long useful life, the secure facility is essentially a building, which should last a significant period of time.
70. As stated, the POC-IS is a server and given that information technology requires periodic updating, we have assumed that after four years the server becomes worthless and needs to be replaced. We have assumed that the secure facility has a longer expected life, at thirty years, but is again worthless<sup>18</sup> at the end of its life. The life expectancy of the secure facility is likely to be conservative; This assumption is based on the findings of the 2016 English Housing Survey which identified the average age of an English house as 61 years. This implies most houses exist for longer than 61 years, but we have chosen to be more conservative to reflect the need to maintain security.<sup>19</sup> This generates constant depreciation rates of 25% and 3.3% respectively.
71. If we assume that the POC-IS has a lifespan of four years<sup>20</sup>, then it must be replaced twice in our appraisal period of ten years. In the absence of specific information on the cost of replacing the POC-IS we have assumed it is equal to 100% of the initial investment. It could be argued that the cost of replacing the POC-IS could reduce over time, however given the bespoke nature of a POC-IS and insufficient information we have taken the conservative view that the cost remains the same in real terms.
72. Overall, capital costs are the combination of the initial investment coupled with the depreciation and replacement costs, which are all constant across options and total at £8m. These are summarised in Table 2 below.

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<sup>18</sup> Land Value Estimates for policy Appraisal by the department for communities and local government ([https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/407155/February\\_2015\\_Land\\_value\\_publication\\_FINAL.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407155/February_2015_Land_value_publication_FINAL.pdf)) found that the average cost of industrial land per hectare was £482,000 in England. If we use the minimum space requirements per FTE, as stated by the health and safety executive (<http://www.hse.gov.uk/contact/faqs/roomspace.htm>), as an estimate for the office space required and then double it to account for sever space, we estimate the UK CPA would need a maximum of 92m<sup>2</sup>. If we apply this to DCLG's land cost calculation we estimate that the value of the land for the secure UK CPA site would be £4,400, which would translate into 0.3% of the estimated £1.25m cost to build the infrastructure. Therefore we shall assume that the land will be worthless once the building is at the end of its useful life.

<sup>19</sup> <https://www.gov.uk/government/statistical-data-sets/stock-profile>

<sup>20</sup> An estimate of the most cost effective life expectancy of a server was estimated at three to four years <http://www.dell.com/learn/us/en/08/smb/evaluating-the-useful-life-of-a-server>

Table 2: CPA Fixed Capital Costs

Fixed Capital Cost Table	Option 1	Option 2	Option 3	Option 4	Option 5
Capital Cost	£0	£4,865,000	£4,865,000	£4,865,000	£4,865,000
Depreciation Cost	£0	£3,136,000	£3,136,000	£3,136,000	£3,136,000
Total Cost	£0	£8,001,000	£8,001,000	£8,001,000	£8,001,000

## Operational costs

73. In addition to initial set up costs there are operational costs to hosting a UK CPA. These include the day-to-day running of the UK CPA and cost drivers such as encrypted key management. Below we first look at the labour costs involved in performing UK CPA functions and then look at the additional operational costs associated with a UK CPA.
74. The labour costs section is significantly different from that in the consultation-stage impact assessment. In the consultation-stage impact assessment, a maximum of four FTEs was assumed to constitute a UK CPA, while in this analysis we predict over 10 FTEs in the maximum case. This reflects new work into the operations of a UK CPA, which has been conducted since the consultation-stage impact assessment was conducted. This is explained in more detail below.
75. In order to assess the labour costs we first need a view of the roles a UK CPA would address. The UK Space Agency commissioned a study<sup>21</sup> into a UK CPA, which looked at this. The report identified 18 roles, which can be seen in Figure 1, Annex A. It should be noted that not all of these roles are FTE and through discussions with UK Space Agency policy experts we have reduced these CPA functions into 10 FTE roles as can be seen in Table 10.
76. We expect that different options have different labour requirements, with Option 3 outsourcing certain CPA roles leading to lower labour requirements for the UK CPA. Moreover, where CPA functions are held by another government department, the labour requirements are assumed to be 10% higher as discussed in paragraphs 49- 51. Table 12 presents the roles of Figure 1 by location, i.e. whether a specific role lies with the UK CPA, another government department, a foreign CPA or is held externally.
77. In addition, for Option 3 we assume the foreign CPA charges are identical to Option 2 but with an additional mark-up of 25% over these baseline costs. . We make this assumption on the basis that a foreign CPA is unlikely to be willing to use national resources for the benefit of the UK without some form of reward. It is impossible to know what mark-up would be charged, as this would be established through negotiation, but we make the assumption that any mark-up would range from 0% to 50% and we take the midpoint of 25% in the absence of additional information. While the precise value of any mark-up could be argued, the main point to bear in mind is that if the mark-up is greater than zero, Option 3 will be a more costly option than Option 2.
78. Now that we have a view of the level of labour required by each option we need an assessment of labour cost, which requires assignment of civil service grades. We shall assume that all roles are

<sup>21</sup> QinetiQ and CGI (2015), UKSA CPA Development WP1A

held outside of London and we will use the national pay scales as a result.<sup>22</sup> The grade assignment can be seen in Table 11 and was decided through knowledge of the CPA roles for each FTE and through discussion with UK Space Agency experts.

79. The salaries for each grade are assumed to be the midpoint of the range except for the technical officer who due to the expertise required is paid at the top of the salary band. Non-wage labour costs are calculated with mark-ups by grade, which were estimated by combining employer national insurance contributions and pension contributions.<sup>23</sup> The total cost by team is shown in Table 3's penultimate column.

80. We can now calculate the total labour costs by option by combining Tables 10 and 12 and by taking account of a scaling up phase. The total real labour costs per team are shown in table 3. Option 2 presents the lowest labour costs at £2.8m over the ten-year appraisal period, with Option 3 providing the highest labour costs at £3.3m largely due to an assumed mark-up over cost.

81. One cost area we have omitted from this analysis is the training and recruitment costs. These costs would be highest under option 2 with all roles having to be recruited for and potentially trained. The technical CPA functions (e.g. crypto management) would be difficult to source, expensive to train and potentially impractical. We have chosen not to quantify the training cost because we would require an assessment of the likely level of skill a CPA could attract and then an estimate of the cost to upskill that individual.

Table 3: Labour Costs

Real Labour Cost	Option 1	Option 2	Option 3	Option 4	Option 5
UK CPA Director	£0.00	£53,000.00	£53,000.00	£58,000.00	£58,000.00
UK CPA	£0.00	£437,000.00	£437,000.00	£437,000.00	£437,000.00
Policy Support Officer	£0.00	£225,000.00	£225,000.00	£248,000.00	£225,000.00
Security Officer	£0.00	£419,000.00	£524,000.00	£461,000.00	£461,000.00
Operations Team	£0.00	£562,000.00	£703,000.00	£618,000.00	£562,000.00
PRS Equipment Officer	£0.00	£297,000.00	£372,000.00	£327,000.00	£327,000.00
Technical Officer	£0.00	£428,000.00	£535,000.00	£471,000.00	£471,000.00
Auditor	£0.00	£418,000.00	£418,000.00	£460,000.00	£460,000.00
Total	£0.00	£2,839,000.00	£3,267,000.00	£3,080,000.00	£3,001,000.00

82. The second branch of operational costs includes accommodation costs and hosting secure infrastructure. Significant research has not been conducted into these areas and as a result the costs are similar to the consultation-stage impact assessment, though re-based into 2016/17 prices.

83. These costs are summarised in Table 4 and are broken down into four areas: accommodation, hosting secure infrastructure, connection upkeep cost between CPA and GSMC, and the management of cryptographic keys. Accommodation costs represent the office space costs for UK CPA FTEs and are calculated as the cost per FTE of the Swindon office<sup>24</sup> and BEIS ICT re-charges<sup>25</sup> multiplied by the predicted FTEs for each option. Hosting secure infrastructure<sup>26</sup>, connection

<sup>22</sup> This is assumed because the UK Space Agency is based outside of London.

<sup>23</sup> <http://www.civilservicepensionscheme.org.uk/employers/employer-contribution-rates/>  
<https://www.gov.uk/guidance/rates-and-thresholds-for-employers-2016-to-2017>

upkeep<sup>27</sup> and key management<sup>28</sup> costs were estimated by UK Space Agency policy experts. In general these costs are identical across options because they largely surround the operation of the POC- IS.

84. The lowest operational cost option is Option 3 at a total cost of £5.2m over the appraisal period, which is due to reduced accommodation cost. Option 4 presents the most expensive operational option at £5.6m. However, with only £0.4m separating all options over the entire appraisal period, they are broadly similar in cost terms.

Table 4: CPA Operation Costs

Real	Option 1	Option 2	Option 3	Option 4	Option 5
Accommodation Costs	£0.00	£667,019.63	£308,662.36	£725,994.89	£717,707.38
Hosting Secure Infrastructure	£0.00	£3,275,009.20	£3,275,009.20	£3,275,009.20	£3,275,009.20
Cost of Establishing a permanent connection from the CPA to GSMC	£0.00	£146,230.85	£146,230.85	£146,230.85	£146,230.85
Key Management	£0.00	£1,456,814.04	£1,456,814.04	£1,456,814.04	£1,456,814.04
<b>Total</b>	<b>£0.00</b>	<b>£5,545,073.71</b>	<b>£5,186,716.45</b>	<b>£5,604,048.98</b>	<b>£5,595,761.47</b>

### Option Cost Comparison

The following section provides a comparison of the costs attributable to each of the options considered in this Impact Assessment.

Table 5: Total Cost

	Option 1	Option 2	Option 3	Option 4	Option 5
Capital Cost	£0.00	£8,001,000.00	£8,001,000.00	£8,001,000.00	£8,001,000.00
Operations Cost	£0.00	£5,545,000.00	£5,187,000.00	£5,604,000.00	£5,596,000.00
Labour Cost	£0.00	£2,839,000.00	£3,267,000.00	£3,080,000.00	£3,001,000.00
<b>Total Cost</b>	<b>£0.00</b>	<b>£16,385,000.00</b>	<b>£16,455,000.00</b>	<b>£16,685,000.00</b>	<b>£16,598,000.00</b>

85. The main variable across different options is the labour requirements with infrastructure costs assumed to be constant across options. Option 2 is a standalone CPA scenario with all of the CPA’s functions (outlined in Figure 1, Annex A) held in house, which is estimated to require a total of 9.1 FTEs. Option 3 involves outsourcing CPA roles leading to a reduced labour requirement. Options 4 and 5 involve OGDs performing aspects of the UK CPA’s role, which we assume, due to co-ordination issues, requires in total 10% more labour time. The different labour requirements for each

<sup>24</sup> The cost per FTE in the UK Space Agency’s Swindon office was £8,930 in 2016/ 17.

<sup>25</sup> The cost per person for ICT equipment for the UK Space Agency is £2650 in 2016/ 17.

<sup>26</sup> There will be general upkeep costs of ensuring the UK CPA is secure, including physical security.

<sup>27</sup> A constant direct connection is required between the UK CPA and the GSMC.

<sup>28</sup> In order to access PRS, users will need to be given encrypted keys to access the signal and their management will be a function of CPAs.

option are presented in Table 10. Labour time is then converted into labour costs through grade and salary assignment, outlined in paragraph 79.

86. It is possible to present arguments against the assumption of 10% more labour time for roles outsourced to OGDs. However, if we believe that individuals in different departments will find it more difficult to arrange meetings, to co-ordinate work streams, to ensure all stakeholders are adequately informed then it seems reasonable that the labour time required for each role will rise.
87. In addition, to the direct labour costs of hosting a CPA there are accommodation and IT costs.<sup>29</sup> These costs are estimated as the current BEIS IT charges for the UK Space Agency and the cost of the Swindon office per FTE, which is £2,650 and £8,930 respectively. Therefore accommodation costs and IT costs rise proportionally with each FTE.
88. In Option 3 some UK CPA functions are performed by a foreign CPA. We have assumed that the foreign CPA will seek compensation for using their services. We assumed in the absence of specific information that the cost of performing any CPA function requires the same amount of labour time across EU MSs, that the labour costs are identical and that the foreign CPA will charge a premium of 25%. This makes labour costs in Option 3 the most expensive but is only £0.4m<sup>30</sup> more than Option 2. It is possible to argue that a foreign country would charge less for their services and perhaps competition amongst foreign CPAs would drive this cost down. However, it seems a reasonable assumption that there would be a premium of some form due to inelastic UK demand and unless a foreign CPA has substantially lower labour costs that implies Option 3 would be more expensive.
89. The main difference between option costs is labour requirements. Option 2 where there is a standalone UK CPA is presented as the lowest cost option. It is possible to present different arguments for the mark-up used in Option 3 and the level of increased labour requirements in options 4 and 5. However, if we believe that a foreign CPA would charge a premium and that multiple organisations representing the UK CPA would lead to co-ordination issues, then labour costs will be higher in Options 3 to 5, it is merely a question of magnitude.
90. Overall, even withstanding a foreign CPA charging a premium and other government departments hosting CPA functions leading to inefficiencies the costs are broadly constant across every option. While we assume that outsourcing CPA functions to OGDs is less efficient than undertaking all the functions in house, this is a conservative assumption. In practice these costs may be similar cost and may be less expensive. Table 5 summarises the total costs of each option with Option 2 providing the lowest cost at £16.4m and Option 4 the highest cost at £16.7m. Therefore, from a cost standpoint each option is broadly similar, with Option 2 providing marginally the lowest cost.
91. However, as discussed, this analysis has omitted any training and recruitment costs due to insufficient information. It is likely that training and recruitment costs will be significant under Option 2, but it is unlikely that they would be £0.3m more than Option 4, suggesting it will still be less expensive than the most expensive option. However, it may not be practical to attempt to source and train individuals for technical CPA functions and this should be taken into account.

## Benefits

92. The benefits of Options 2 to 5 are assessed in comparison to the status quo 'Do Nothing' Option 1. A Competent PRS Authority unlocks the key benefits to the main parties affected, namely PRS

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<sup>29</sup> Note that these costs are in addition to the cost of 'hosting secure infrastructure' because these costs reflect areas such as admin, desk allocation and security.

<sup>30</sup> Note this is because only those CPA FTEs which are outsourced receive a mark-up.



technology users and manufacturers, regardless of the form the CPA takes. As such the benefits of Options 2 to 5 are treated together.

## Benefits to potential PRS users

### Option 1

93. Under the 'Do Nothing' option, no potential PRS users are able to access PRS, nor are UK industry able to produce, develop or export PRS equipment. There are therefore no benefits which accrue under this option.

### Options 2 to 5

94. The benefits to PRS users are in essence those benefits that PRS offers over other satellite navigation systems as well as the benefit to users of receiving multiple secure signals. The first Galileo satellites were launched in October 2011 and the first test of PRS signal receivers took place in March 2012. To date 18 satellites out of 30 have been launched into orbit and PRS testing is underway. The Galileo constellation along with PRS are expected to be fully operational by 2020 thus, many of the benefits of PRS are only likely to be fully understood as the service and the technologies which support it become more mature.

95. The key benefits of PRS over other substitutes (such as Galileo Open Signal or GPS open signal) are likely to be:

- a. **Resilience to Spoofing.** Publicly available signal structures and interface control documentation make open GNSS services relatively easy to replicate spuriously. Existing GNSS infrastructures do not allow users to authenticate signals readily and in real time, rendering them vulnerable to spoofing, the broadcast of fake GNSS-like signals, and meaconing (the rebroadcast of same GNSS signals to create confusion). PRS is highly encrypted which makes it far more resilient to spoofing. In this context, an additional benefit of PRS is that the complex nature of the encryption algorithm means that the signal identifies itself as authentic by virtue of being decrypted.
- b. **Resilience to Jamming.** Hostile or malicious GNSS jammers (devices which emit random noise to interfere with a signal) are proliferating, boosted by low prices and do-it-yourself information on GNSS. As critical infrastructure, GNSS is a likely target for malicious organisations. PRS signal broadcasts wideband signals on frequencies separate from GNSS open services, thus offering some resilience to jamming. In addition, technology can be built into receivers to help mitigate jamming, albeit at an extra cost.
- c. **Availability in times of crisis.** PRS is a highly encrypted service available only to government-authorised users. In times of crisis or in the event that other GNSS signals may be temporarily unavailable, PRS services will continue to support those authorised to use it.
- d. **Interoperability with other GNSS services.** Although PRS is independent from other GNSS signals, it will be interoperable with GPS open services. In an increasingly multi GNSS environment, this sort of combined use is already being developed by receiver manufacturers to offer enhanced performance in terms of accuracy, integrity, continuity and availability of Position Navigation Timing (PNT) services, including greater resilience to interference and jamming.

## *Relative benefits to PRS technology users across options*

96. Once PRS use has been authorised the benefits to PRS users are unlikely to vary very much across options. This is because the benefits of PRS outlined above derive from the technology, not from the CPA. However, the CPA is necessary to unlock these benefits.
97. It is possible that under Option 2, where there is only one point of contact due to all CPA functions being held centrally, the service provider will be quicker, which could reduce the time before users start receiving benefits. However, this is likely to be a very marginal change in the benefits received with any differences in service time not expected to be significant.

## **Benefits to potential PRS technology manufacturers**

### **Option 1**

98. Under the 'Do Nothing' option, no potential PRS manufacturers are able to access PRS and thus there are no benefits.

### **Options 2 to 5**

99. The key benefits to PRS technology manufacturers of having a UK CPA will be the ability to access the market for PRS. This UK manufacturing market is estimated at £50m p.a. and in addition the MOD estimates that military exports are likely to incorporate PRS access. Although the MOD cannot be sure what portion of these exports is dependent upon PRS, total UK military exports are worth £7.7bn p.a. Therefore, even if only 0.3% of these exports were retained for one year, the revenue saved would cover the cost of the most expensive CPA option for the entire appraisal period<sup>31</sup>. The security of PRS means it is likely to feature in military technology and if UK firms cannot access PRS that would undermine their competitiveness.
100. For the purposes of this assessment we shall ignore the military export benefits due to insufficient information on the true value of PRS dependent exports. We shall instead use the PRS manufacturing market estimates from industry of £50m p.a. We convert this revenue into GVA to give net output, using the average space manufacturing GVA to revenue ratio (45%)<sup>32</sup>, which translates into £22.5m p.a. In addition, we treat the estimates of the market size as real values, with the expectation that the market value will grow with inflation. This is arguably conservative, given the 8% annual growth in the UK space industry over the past decade.<sup>33</sup>
101. We do not know at what point the market will reach the £50m p.a. of revenue due to the embryonic nature of the PRS market. In the absence of additional information we take a conservative view that the manufacturing market reaches full potential in the tenth year of operations and half potential in the fifth year of operations with step changes. This approach should be viewed as conservative because we ignore any additional benefits as the market ramps up from zero revenue to half potential in year five and from half potential to full potential in year 10. See Graph 1 below, where it should be noted that the revenues have been converted to net output impacts as above.

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<sup>31</sup> The appraisal period is 10 years.

<sup>32</sup> London Economics (2016), Size and Health of the UK Space Industry. In the absence of robust data from manufacturers on manufacturing costs, this approach allows us to generate an estimate of how the revenues will translate to a net impact.

<sup>33</sup> *ibid*

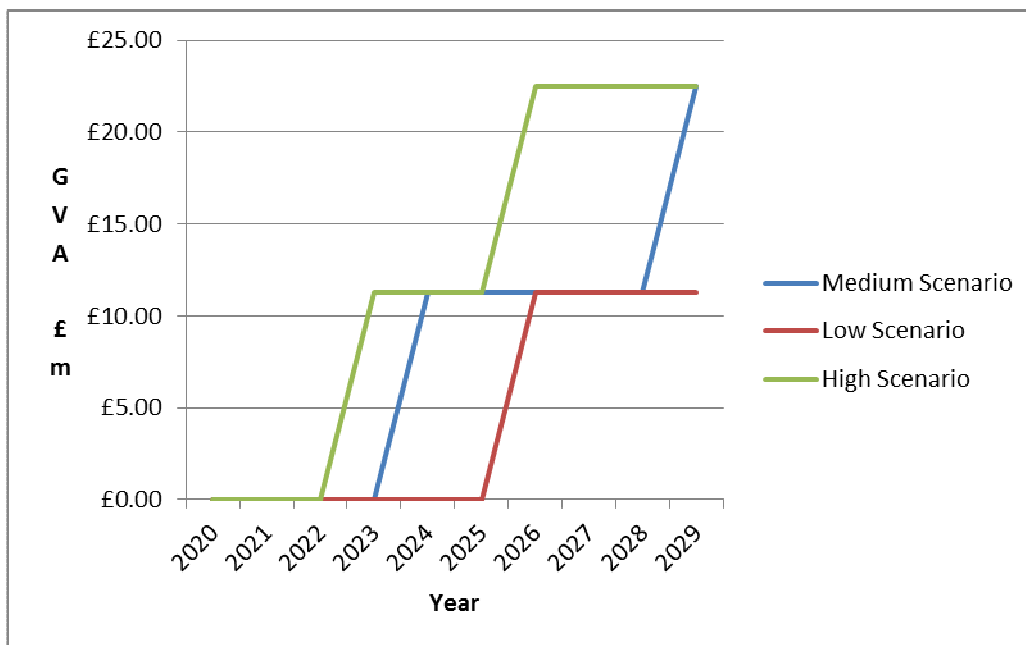
102. In addition, due to the importance of the timing assumption to the overall benefits we include a low and a high scenario to demonstrate the impact. In the low scenario we assume that there are no benefits from PRS manufacturing until year six and that the PRS market does not reach full capacity in the appraisal period but instead remains at half capacity from year seven to year 10. While in the high scenario we assume that there are zero benefits until year three, then half benefits from year four to year six and full benefits from year seven onwards. The discounted benefits from the low, medium and high scenarios are shown in T5.

103. While it is clear from Table 5 that the timing assumption is important to the benefits, with real discounted benefits ranging from £36m to £101m, it should be borne in mind that even the lowest scenario produces benefits (£36m) over twice the magnitude of the total costs (£17m). While a high scenario would produce benefits almost six times the size of total costs. In addition, PRS users will choose to engage in PRS and we can presume they will benefit from using PRS, raising the total benefits.

Table 5: Total Benefits

Benefits	Real Revenue	Real Benefits	Real Discounted Benefits
Low Scenario	£100,000,000	£45,000,000	£36,060,000
Medium Scenario	£175,000,000	£78,750,000	£63,930,000
High Scenario	£275,000,000	£123,750,000	£101,090,000

Graph 1- PRS Manufacturing GVA



*Relative benefits to PRS technology manufacturers across options*

104. As was the case for PRS users, so it is for PRS technology manufacturers that once PRS technology manufacture has been authorised the benefits to manufacturers in terms of access to the market for PRS should be largely the same across Options 2 to 5.

105. Under Option 3, however, oversight of technology manufacturers lies with the CPA of another MS. This could hold significant commercial risks if that MS is a key competitor in the market for PRS. In that case the benefits under Option 3 could be less than under other options. It is assumed, however, that the CPA designated by the UK under Option 3 would be chosen to minimise this risk and any agreement signed would try to mitigate this risk.

### Comparison of costs and benefits

106. The benefits and the costs are broadly similar across each option. The benefits are assumed to be equal across different CPA options and the costs vary by up to £0.3m. This makes it difficult to select an option based upon a comparison of the costs and benefits.

107. Using the present value of total benefits shown in Table 5 we can calculate a net present value, which is shown in Table 8. Although, since we assume total benefits are fixed across options, this is merely a linear transformation of total costs. However, it does illustrate that even ignoring the significant £7.7bn p.a. of military exports partially dependent upon PRS we can still expect benefits of a UK CPA to outweigh the costs by several fold.

108. However, it should be noted that due to insufficient information on how the CPA will function, we have not calculated the business net present value. Although, it should be pointed out that all costs are indirect and any firms which engage in PRS will presumably expect to benefit.

109. In addition to the quantifiable benefits there are additional areas to consider, such as deliverability of the CPA. We have already discussed the potentially large cost of sourcing technical skills directly for the CPA but it may not be feasible to source them due to the specialism involved or because sourcing will have to be made at great cost. This is discussed in more depth in the multi-criteria analysis section.

Table 7: Total transition and recurring costs for Options 1 to 5

		<b>Option 1: Do Nothing</b>	<b>Option 2: New government body</b>	<b>Option 3: De minimis</b>	<b>Option 4: Federated approach</b>	<b>Option 5: Amalgamated approach</b>
<b>Capital Costs</b>	Low	£0m	£5.54m	£5.54m	£5.54m	£5.54m
	High	£0m	£10.46m	£10.46m	£10.46m	£10.46m
	Best estimate	£0m	£8m	£8m	£8m	£8m
<b>Average Annual</b> (Excluding transition, constant price)	Low	£0m	£0.58m	£0.56m	£0.56m	£0.58m
	High	£0m	£0.71m	£0.75m	£0.72m	£0.74m
	Best estimate	£0m	£0.65m	£0.65m	£0.67m	£0.66m
<b>Total Cost</b> (present value)	Low	£0m	£13.11m	£12.77m	£12.77m	£13.1m
	High	£0m	£19.67m	£20.19m	£19.82m	£20.1m
	Best estimate	£0m	£16.39m	£16.46m	£16.69m	£16.6m

Table 8: Net Present Value

	Option 1	Option 2	Option 3	Option 4	Option 5
Total Benefits	£0	£63,932,000	£63,932,000	£63,932,000	£63,932,000
Total Costs	£0	£16,388,000	£16,463,000	£16,688,000	£16,602,000
Net Present Value	£0	£47,544,000	£47,469,000	£47,244,000	£47,330,000
NPV/ Total Cost	£0	2.90	2.88	2.83	2.85

## Equivalent annual net direct cost to business (EANDCB)

110. This analysis has not calculated an EANDCB due to insufficient information on the total benefits arising from PRS. The total benefits from PRS will not become clear until full services become available and firms begin to use the system. In addition, firms will choose to engage in PRS and will have to acquire PRS receivers in order to access this signal and we can infer from this that any firm wishing to engage in PRS will perceive a net benefit. Therefore, while we can safely say that there will be a net benefit to businesses from choosing to engage in PRS we cannot quantify this benefit, at this stage.

## Risks and assumptions

111. A number of assumptions have been made in appraising the costs and benefits associated with different forms of establishing a Competent PRS Authority. The key risks and assumptions of the appraisal are discussed below in more detail.

### *Costs of delivering CPA functions in other parts of government:*

112. Where functions are carried out within the UK CPA under Option 2 but carried out in other parts of government in Options 4 or 5, labour costs are assumed to be 0% - 20% higher in Options 4 & 5 to reflect the increased administrative effort to co-ordinate between these partners. In the absence of additional information we take the midpoint 10% and apply it to all FTEs held in another government department as a mark-up. However, it could be argued that the costs of leveraging capability from other parts of government in Options 4 and 5 could cost less than the predicted costs under Option 2. This is because existing capability may deliver functions more efficiently, due to having access to a wider pool of experience. Overall, we shall take a conservative view and assume the loss of co-ordination leading to higher costs dominate, making Options 4 and 5 relatively more expensive.

### *Cost of designating another Member State's CPA:*

113. In the absence of any other MS having developed a fully functioning CPA it is not possible to estimate precisely the fee that would be charged by another CPA. It is assumed that cost estimates should be equal to those made for UK estimates where these estimates represent costs which would be incurred by the other MS's CPA (e.g. key management and distribution, and user and manufacturer oversight). The assumption was made that a premium between 0 and 50% would be charged, with a best estimate of 25 per cent. This premium accounts for the fact that MSs may charge a "consultancy fee" to the UK for the services provided. In the absence of this 25 per cent premium, the Net Present Value of Option 3 would be identical to Option 2 in cost and therefore could be an attractive option, although the commercial risks are still significant under this option. It is considered unlikely that another MS would not charge a premium over marginal costs.

### *Commitment from OGDs:*

114. It is assumed that OGDs are currently operating at full capacity and any new CPA functions would fall relatively low down their priorities list. We assume that this leads to an increased labour burden through the need to co-ordinate. We do not assume that the OGD charges the UK CPA for their services but that existing functions are prioritised relative to UK CPA functions.

### *Designation of PRS functions:*

115. In Option 3 it is assumed that certain CPA functions are delegated to the CPA of another MS where delegation of these functions is practical and not thought to damage national sovereignty. The assignment of functions in Table 12 follows from discussions with UK Space Agency policy experts taking account of practicality and security considerations. These will be the subject of further consultation and more functions which in turn could affect the costs.

### *Benefits of PRS technology to the user community:*

116. The key benefits of PRS technology to the users of PRS lie in its increased resilience to spoofing and jamming and its availability in times of crisis as well as the possibility of interoperability with other

GNSS technology. With this embryonic technology its benefits relative to GPS have yet to be proven. There is a significant risk that uptake of PRS technology will be low in the beginning. Thus, it could be envisaged that the role of the Competent PRS Authority in the early years would be to authorise the manufacture of PRS technology as the user community may remain small or non-existent. In that case the costs of running the CPA would be significantly reduced in all cases. The analysis undertaken here assumes a PRS user community from the outset in order to allow for a complete options analysis for the long term. Similarly, this analysis makes the simplifying assumption that the costs pertaining to monitoring and managing users and manufacturers over time are constant. Although it is unlikely that this will be the case, as it is envisaged both groups will grow over time, in the absence of predictions as to the market size of PRS a constant, modest size was assumed.

117. Throughout this analysis we have assumed that there is significant demand for CPA services in the UK. It is possible that this demand will not be realised and if that is the case the UK would not invest in infrastructure or set up a large team, reducing costs to a minimum<sup>34</sup>. However, the analysis to date demonstrates a potentially strong uptake of PRS services with a corresponding need for a relatively sophisticated UK CPA.

### **Cost-benefit analysis summary**

118. As articulated by EU Decision 1104/2011 the UK will need to set up a competent PRS Authority in order to authorise the use of PRS and the manufacture of PRS equipment. PRS offers users greater resilience to spoofing and interference relative to Galileo's and GPS's open service. In addition, the manufacture of PRS equipment is estimated to lead to revenues of £50m p.a. along with PRS enabled military exports potentially leading to billions of pounds of benefits (the latter not included in NPV calculations).

119. The UK has four CPA options available to it, all with relatively similar total costs but Option 2 is estimated to be the lowest cost option, but it should be borne in mind that the difference in costs are largely due to two assumptions: one, a foreign CPA will charge a mark-up rate and two, splitting CPA roles across government departments requires more work. Moreover, due to the requirement under Option 2 to source technical expertise it may not be practical. In the absence of a conclusive preferred option from the costbenefit analysis we shall perform a multi-criteria analysis to assess the implications for running the CPA service.

### **Multi- criteria analysis**

120. The Cost-Benefit Analysis (CBA) presented above fails to clearly identify a preferred option, with all options' total costs lying within a range of approximately £0.3m. It is then appropriate to use a multi- criteria analysis to compare the quality of service of different options. However, it would not be proportionate to embark on an equally sophisticated Multi Criteria Analysis (MCA), compared to the CBA, given that the costs and benefits are estimated to be broadly equal across options.

121. We shall assess five areas of quality as highlighted below in Table 9. Each criterion is ranked on a scale 'Low' to 'High' with 'High' representing the best possible outcome of the criterion in question. In addition, the best option for each criterion is highlighted in green and the worst option is highlighted in red.

122. '**Speed of Service**' reflects how quickly prospective PRS users and PRS equipment producers will be able to receive a licensed service and therefore how quickly they can start generating benefits. In addition, the CPA will be providing a service on areas such as information and encrypted key management and the lower the points of the contact the less burdensome a process is placed on users. We shall also assume that in the steady-state equilibrium all options have recruited professional experts for all roles, resulting in the only difference being points of contact. For this reason Option 2 is assessed to produce the best 'speed of service', with all other options resulting in more than one point of contact. We also assess Option 3 to be the worst performer in this criterion, with the difficulties of contacting CPA functions in a foreign country (language, different time zone etc.) being the dominant factor.

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<sup>34</sup> The UK Space Agency already has an individual in post who could deal with minimal additional investment could use this manual system.

123. **‘Scalability’** the second criterion is scalability, which is the ability of the CPA to grow to meet demand. On one hand, if all functions are held in-house the CPA can adjust resources to demand, but on the other hand, if CPA functions are held externally depending upon contractual arrangements, it is possible for an external provider to scale with demand using in-house resources. We take the view that Option 4 balances this approach, whereby an external provider is more easily able to meet the demand of technical CPA functions and still able to internally increase resources for non-technical roles. We also take the view that because a foreign CPA will likely require formal contractual arrangements, they may be less able to readily scale their resources to meet demand.
124. The importance of scalability should not be underestimated to the success of the CPA. The speed to which users and manufacturers of PRS equipment start benefitting from PRS is dependent upon speed of service. If the UK CPA is unable to increase resources to meet demand it could bottleneck the UK PRS market and reduce the benefits the UK derives from PRS.
125. In relation to **‘Security and Risk’**, EU decision 1104/2011 implores the member states to ensure the security of PRS information and equipment, making security of paramount responsibility for a CPA. We make the assumption that under all scenarios in the steady-state equilibrium, professional experts are responsible for security-related aspects of the CPA, resulting in no difference across options. However, we shall assume that additional points of contact increase the risk of miscommunication or a loss of important information. The implication is that Option 2 becomes the least risky option due to all functions being held centrally, with all other options entailing at least one additional point of contact. Option 4 is viewed as the least secure option because it would involve a variety of different individuals (with the expectation that other government departments would spread CPA functions across a wide group of staff) undermining security and making Option 4 the least secure option.
126. The criterion of **‘Set-up time’** involves the assessment of the ease of setting up a CPA across different options. Here Option 4 is viewed as the easiest to set up because under Option 4 the CPA is able to leverage existing skills throughout the UK reducing the need to recruit and train. On the other hand, Option 3 would be most the difficult to set up and manage, with a suitable foreign CPA having to be sought and negotiated with. In addition, it is likely that a foreign CPA would find it more difficult to source employees with the language and technical skills to perform UK CPA functions.
127. **‘Deliverability’** assesses the plausibility of setting up each option. Here Option 4 also presents the most plausible option by utilising existing skills thus reducing the resources directly required by the CPA as well as reducing the cost of training and recruitment. While it may be difficult to source technical skills under Option 2, and more importantly under Option 3, it may prove highly difficult and complex to draw up a suitable contract and service from a foreign CPA for UK CPA functions.
128. The MCA indicates that Option 4 would be our preferred option. Option 4 is expected to lead to the best outcome for scalability, set-up time and deliverability and gaining a medium score on speed of service with only one low score for security and risk. In general, Option 4 presents the best way forward from a management point of view, with Option 2 potentially not being practical. Option 5 does not fully leverage skills across government and Option 3 would require a restrictive and potentially difficult-to-negotiate contract.

Table 9: Multi-criteria analysis matrix

	Option 2- New Government Body	Option 3- De Minimis	Option 4- Federated Approach	Option 5- Amalgamated Approach
Speed of Service	High	Low	Medium	Medium
Scalability	Medium	Low	High	Medium
Security & Risk	High	Medium	Low	Medium
Set-Up Time	Low	Medium	High	Medium
Deliverability	Medium	Low	High	Medium
Average	Medium	Low	High	Medium

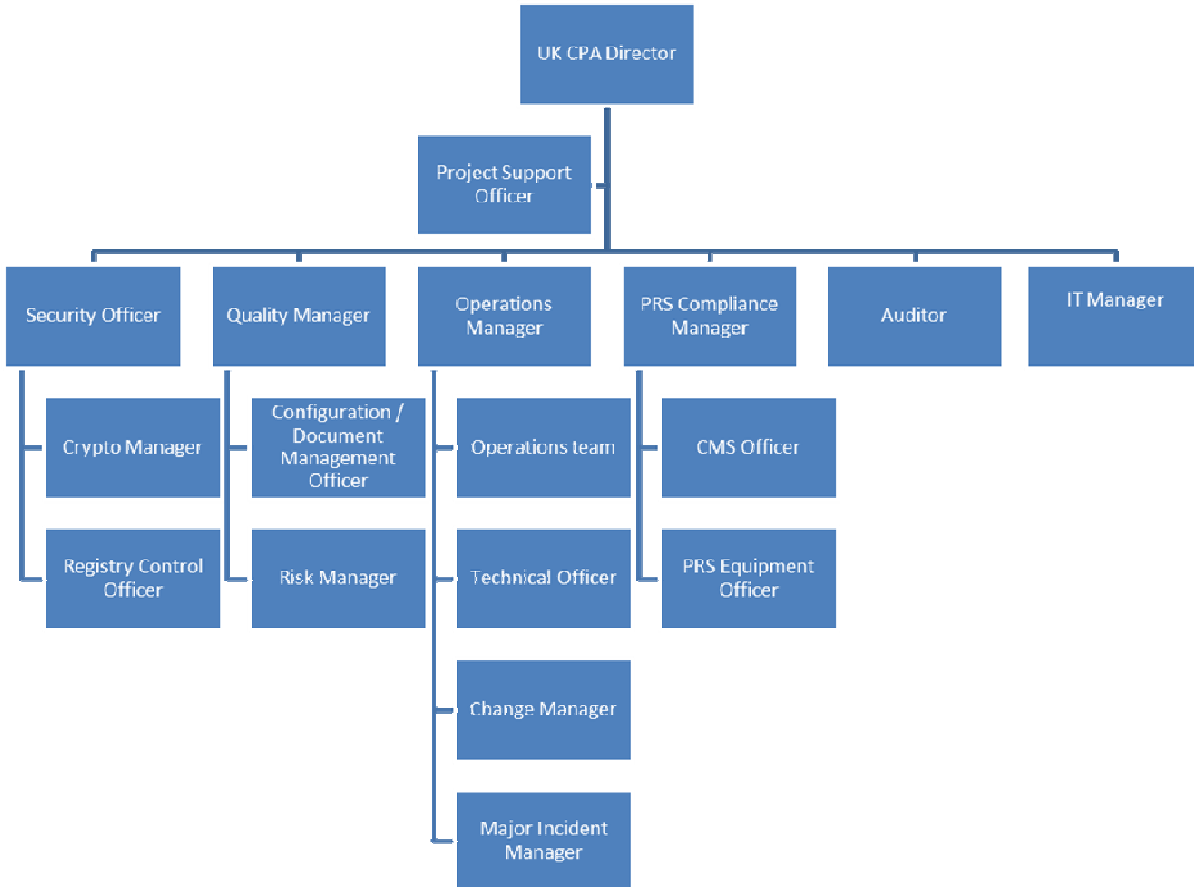


## Summary

129. Despite an estimated higher cost relative to Option 2, the preferred option is Option 4. With the costs and benefits largely being the same across options, factors such as service provided and management of the CPA should dominate. For this reason Option 4 is our preferred option, producing the highest score on scalability, set-up time and deliverability. This largely occurs because Option 4 allows for the balance between externally allocating the technical roles to partner organisations whilst retaining non-technical roles in-house.
130. This federated approach allows the UK Space Agency to utilise existing MOUs and relationships with OGDs (e.g. GCHQ) and prevents the duplication of roles across different OGDs. The implication of this is that a well-executed Option 4 could require fewer resources from a wider government viewpoint but we have taken a conservative view. While the lowest cost option, Option 2 may well not be practical and would be very difficult to secure the right level of expertise.

**Annex A**

**Figure 1: UK CPA Functions**



Note: this is CPA functions and each function does not represent 1 FTE worker.

**Figure 2: CPA timeline.** *(Source: QinetiQ and CGI UK CPA development*

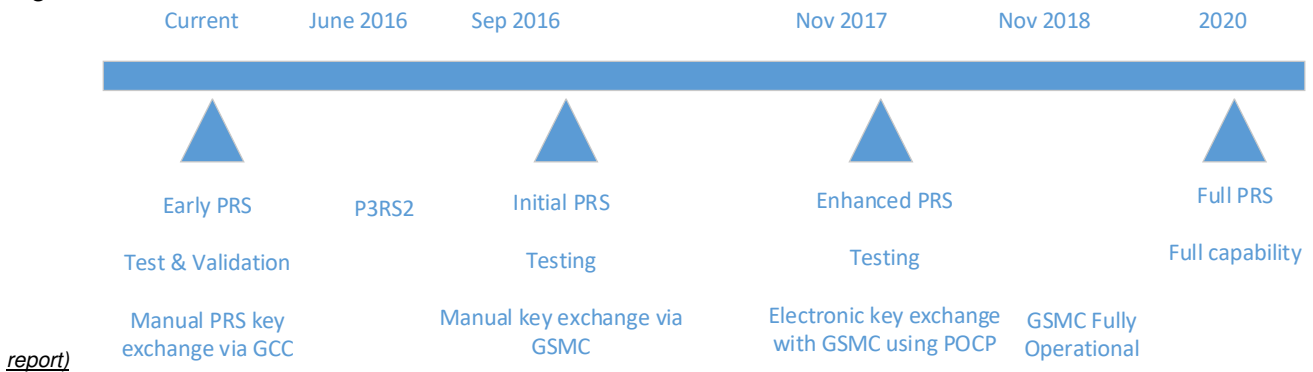
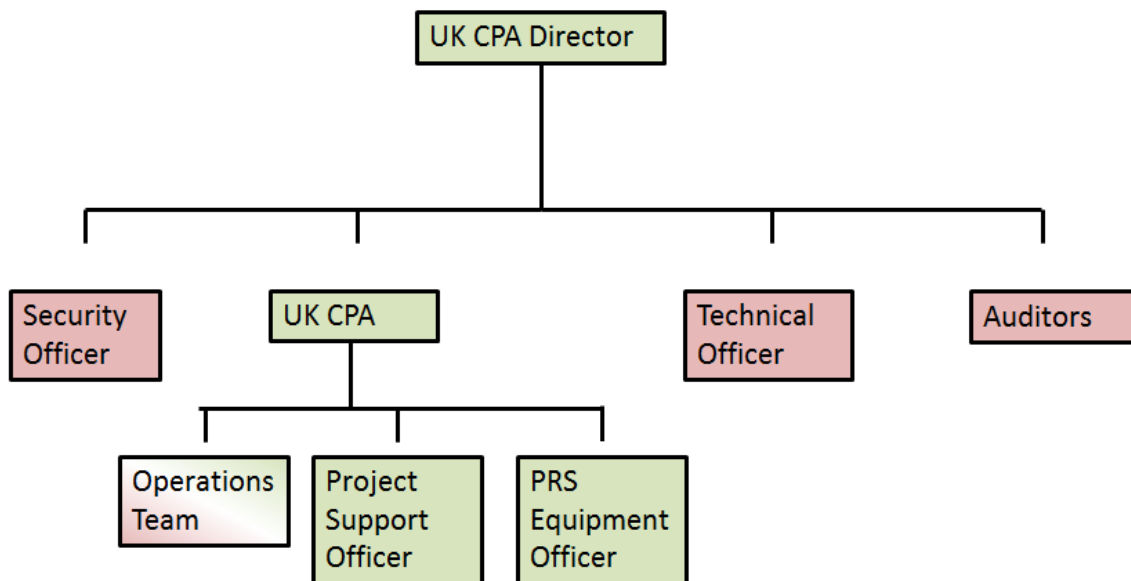


Figure 3: Option 4 CPA organogram



Key	
UK CPA	
OGD	

Table 10: Labour requirements

	Option 1: Do nothing	Option 2: New government office	Option 3: De minimis	Option 4: Federated approach	Option 5: Amalgamated approach
UK CPA Director	0	0.1	0.1	0.11	0.11
UK CPA	0	1	1	1	1
Project Support Officer	0	1	1	1.1	1
Security Officer	0	1	0	1.1	1.1
Operations Team	0	2	0	2.2	2
PRS Equipment Officer	0	1	0	1.1	1.1
Technical Officer	0	1	0	1.1	1.1
Auditor	0	2	2	2.2	2.2
<b>Total</b>	<b>0</b>	<b>9.1</b>	<b>4.1</b>	<b>9.91</b>	<b>9.61</b>

Table 11- UK CPA roles grading

Role	Grade	Salary Range	Expected Salary	Uplift
UK CPA Director	6	£54,494 - £64,214	£59,354.00	£80,662.09
UK CPA	7	£44,983 - £52,870	£48,926.50	£66,491.11
Project Support Officer	HEO	£26,310 - £29,833	£28,071.50	£37,812.31
Security Officer	7	£44,983 - £52,870	£48,926.50	£66,491.11
Operations Team	SEO	£32,273 - £37,781	£35,027.00	£47,181.37
Technical Officer	7	£44,983 - £52,870	£52,870.00	£71,850.33
PRS Equipment Officer	SEO	£32,273 - £37,781	£35,027.00	£47,181.37
Auditor	7	£44,983 - £52,870	£48,926.50	£66,491.11
Auditor	SEO	£32,273 - £37,781	£35,027.00	£35,027.00
Average Auditor	N/ A	N/ A	£41,976.75	£50,759.06

Not all of these roles are FTE and some already exist within government

Table 12: Roles by option

Roles	Option 1	Option 2	Option 3	Option 4	Option 5
UK CPA Director	N/A	UK CPA	UK CPA	UK CPA	UK CPA
UK CPA	N/A	UK CPA	UK CPA	UK CPA	UK CPA
Project Support	N/A	UK CPA	UK CPA	UK CPA	UK CPA
Security	N/A	UK CPA	Non- UK EU MS CPA	OGD	UK CPA
Cryptography	N/A	UK CPA	Non- UK EU MS CPA	OGD	OGD
Registry Control	N/A	UK CPA	Non- UK EU MS CPA	OGD	OGD
Quality Manager	N/A	UK CPA	Non- UK EU MS CPA	UK CPA	UK CPA
Configuration/ Development management	N/A	UK CPA	Non- UK EU MS CPA	UK CPA	UK CPA
Risk Manager	N/A	UK CPA	UK CPA	UK CPA	UK CPA
Operations Manager	N/A	UK CPA	Non- UK EU MS CPA	OGD/ UK CPA	UK CPA
Operations Team	N/A	UK CPA	Non- UK EU MS CPA	OGD/ UK CPA	UK CPA
Technical Officer	N/A	UK CPA	Non- UK EU MS CPA	OGD	OGD
Change Officer	N/A	UK CPA	Non- UK EU MS CPA	UK CPA	UK CPA
Major Incident Officer	N/A	UK CPA	UK CPA	OGD	UK CPA
PRS Compliance Officer	N/A	UK CPA	UK CPA	UK CPA	UK CPA
CMS Officer	N/A	UK CPA	UK CPA	UK CPA	UK CPA
PRS Equipment Officer	N/A	UK CPA	Non- UK EU MS CPA	UK CPA	UK CPA
Auditor	N/A	UK CPA	UK CPA	OGD	OGD
IT Manager	N/A	External	External	External	External

## **Common Minimum Standards**

### ***As extracted from the Annex to Decision 1104/2011/EU***

The common minimum standards to be complied with by the competent PRS authorities are set out in the Annex of the Decision 1104/2011. They relate to the use of PRS, the development and manufacture of PRS receivers or security modules and for export restrictions. These common minimum standards are described below.

The common minimum standards for the use of PRS cover the following areas:

- (i) PSR user group organisation;
- (ii) Definition and management of access rights for PRS users and user groups of PRS participants;
- (iii) Distribution of PRS keys and related classified information between the GSMC and the competent PRS authorities;
- (iv) Distribution of PRS keys and related classified information to the users;
- (v) Security management, including security incidents, and risk assessment for PRS receivers and associated classified technology and information;
- (vi) Reporting of detected potentially harmful electromagnetic interference affecting the PRS;
- (vii) Operational concepts and procedures for PRS receivers.

The common minimum standards for the development and manufacture of PRS receivers or security modules cover the following areas:

- (i) PRS user segment authorisation;
- (ii) Security of PRS receivers and PRS technology during research, development and manufacturing phases;
- (iii) PRS receiver and PRS technology integration;
- (iv) Protection profile for PRS receivers, security modules, and material using PRS technology

The common minimum standards for export restrictions cover the following areas:

- (i) Authorised PRS participants;
- (ii) Export of PRS-related material and technology.

The common minimum standards for the links between GSMC and the competent PRS authorities cover data and voice links.