

Title: <i>Liabilities & Insurance 2020</i> IA No: DfT425 RPC Reference No: N/A Lead department or agency: Department for Transport Other departments or agencies: BEIS, UK Space Agency, Civil Aviation Authority, Government Actuary's Department	Impact Assessment (IA)			
	Date: 12/10/2020			
	Stage: Consultation			
	Source of intervention: Domestic			
	Type of measure: Secondary Legislation			
Contact for enquiries: SpaceTeam@df.gov.uk				
Summary: Intervention and Options			RPC Opinion: RPC Opinion Status	

Cost of Preferred Option (in 2016 prices and 2017 net present values)			
Total Net Present Social Value	Business Net Present Value	Net cost to business per year	Business Impact Target Status Qualifying Provision
£1.6m	£1.6m	£0.1m	

What is the problem under consideration? Why is government intervention necessary?
 Under UN space treaties, the UK Government is ultimately liable where it launches or procures the launch of a space object, or where an object is launched from its facilities or territory. The Space Industry Act (SIA) places a liability on persons carrying out spaceflight activities to indemnify the UK Government for any claims made against it, and a liability on operators towards any uninvolved third parties suffering injury or damage. Based on independent commissioned research, the UK Government has determined that a limit on operator liability is necessary to enable UK launch, as the commercial insurance market does not and likely will not provide cover for unlimited liabilities. All other major launching states limit liabilities in some way.

What are the policy objectives and the intended effects?
 The policy aims to use the powers under the SIA to limit operator liability for UK launch activities, specifying that limit in an operator's licence. It also intends to mandate in licence conditions that operators hold or have access to a minimum insurance amount, based on this limited liability. The intended effect is to enable commercially viable and internationally competitive UK launch, whilst ensuring Government is not exposed to excessive risk. It also ensures that any party suffering injury or damage has recourse to compensation.

What policy options have been considered, including any alternatives to regulation?
Option 1: Do Nothing (Counterfactual): Operators continue to hold unlimited liabilities. It is assumed that operators cannot gain unlimited insurance cover from the commercial insurance market. Therefore, operators will continue to launch from other nations (where there are liability limits), so no commercial spaceflight launch industry develops in the UK.
Option 2 (Preferred): Modelled Insurance Requirement: Set the liability limit and insurance requirement on a per-launch basis, reflecting the launch-specific risks (e.g. spaceport location, flightpath, launch vehicle type) and minimising the risk of over-insurance. The Government indemnifies any claimants for claims in excess of the operator's liability limit.
Option 3: €60m Fixed Limit: Set the liability limit and insurance requirement at €60m for UK launch, in line with other European launch nations. The Government indemnifies any claimants for claims in excess of the operator's liability limit.

Will the policy be reviewed? NA. If applicable, set review date: Month/Year						
Does implementation go beyond minimum EU requirements?			N/A			
Is this measure likely to impact on international trade and investment?			Yes			
Are any of these organisations in scope?			Micro Yes	Small Yes	Medium Yes	Large Yes
What is the CO ₂ equivalent change in greenhouse gas emissions? (Million tonnes CO ₂ equivalent)			Traded: N/Q		Non-traded: N/Q	

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:** Date: _____

Summary: Analysis & Evidence

Option 2: Modelled Insurance Req't

FULL ECONOMIC ASSESSMENT

Price Base	PV Base	Time Period	Net Benefit (Present Value (PV)) (£m)		
2020	2021	14	Low: N/A	High: N/A	Best Estimate: N/A

COSTS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant	Total Cost (Present Value)
Low	0.3	1	0.03	0.7
High	1.3	1	0.8	11.6
Best Estimate	0.6	1	0.1	1.9

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

Spaceports, range control service providers, launch or return operators and orbital operators (stakeholders) are expected to face additional direct costs of familiarising themselves with the Liabilities and Insurance legislation and guidance. Operators face additional costs of complying with the licence conditions via insurance costs and UK Government faces additional costs of contingent liabilities. The UK spaceflight regulator faces additional direct costs of engaging with operators, and in modelling the insurance requirements.

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

Due to a lack of accidents and data from such accidents affecting third parties, the cost of accidents to operators (for example, loss of the launch vehicle) have not been monetised. The expected cost of accidents is based on modelling of the flight safety risk and a set of average financial values for death, injury and damage based on compensation arrangements applied in the Courts of England and Wales; so only captures the costs on society. Costs to law-breaking businesses can be ignored (in line with HMG guidance). By contrast, the costs to law-abiding businesses involved in an accident is relevant, but has not been monetised here.

BENEFITS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant	Total Benefit (Present Value)
Low	N/Q		N/Q	N/Q
High	N/Q		N/Q	N/Q
Best Estimate	N/Q		N/Q	N/Q

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

The benefits of enabling commercial spaceflight launches from the UK (through the entire package of secondary legislation) are estimated in the SIA Secondary Legislation Impact Assessment. This option is expected to enable the benefits estimated there. There are no 'additional' benefits of this option over and above those estimated in the SIA Secondary Legislation Impact Assessment (hence the benefits are Not Quantified here).

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

The effects of the UK's Commercial Spaceflight Programme expenditure (investment and consumption) and the associated knowledge spillovers to the wider economy are not monetised because they are attributed to the Programme spend, independent of UK launch. As these benefits are not attributed to launches from the UK, they are not attributed to the secondary legislation that enables these launches.

Key assumptions/sensitivities/risks

Discount rate

3.5

Key assumptions include UK launch market forecasts (pre-Covid-19, low confidence), the expected type/number of and time spent by employees familiarising (medium confidence) themselves with the legislation and guidance, the modelled insurance requirements and launch insurance costs (medium confidence). The main risk is that a commercially sustainable UK launch market does not exist: this possibility is reflected in the low scenario in the SIA Secondary Legislation Impact Assessment.

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) (£m):			Score for Business Impact Target (£m):
Costs: 0.1	Benefits: N/Q	Net: N/A	0.5

Summary: Analysis & Evidence

Option 3: €60m Fixed Limit

FULL ECONOMIC ASSESSMENT

Price Base Year 2020	PV Base Year 2021	Time Period Years 14	Present Value (PV) (£m)		
			Low: N/A	High: N/A	Best Estimate: N/A

COSTS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0.2	1	0.2	2.8
High	0.9	1	1.8	24.4
Best Estimate	0.4	1	0.3	4.9

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

Spaceports, range control service providers, launch or return operators and orbital operators (stakeholders) are expected to face additional direct costs of familiarising themselves with the Liabilities and Insurance legislation and guidance. Operators face additional costs of complying with the licence conditions via insurance costs and UK Government faces additional costs of contingent liabilities. There are no additional costs to the regulator under this option.

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

See above.

BENEFITS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	N/Q		N/Q	N/Q
High	N/Q		N/Q	N/Q
Best Estimate	N/Q		N/Q	N/Q

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

See above.

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

See above.

Key assumptions/sensitivities/risks

See above.

Discount rate (%) 3.5

BUSINESS ASSESSMENT (Option 3)

Direct impact on business (Equivalent Annual) (£m):			Score for Business Impact Target (£m):
Costs: 0.3	Benefits: N/Q	Net: N/A	1.6

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1.0 Policy Rationale

1.1 Policy Background

1. Enabling commercial spaceflight from the UK will make the UK a Launching State. Under UN space treaties, a Launching State is ultimately liable to pay compensation for damage caused by its space objects on the surface of the Earth or to aircraft in flight, and liable for damage due to its faults in space.¹ To mitigate this UK Government liability, Section 36 of the Space Industry Act 2018 (SIA) requires persons carrying out spaceflight activities to indemnify the UK Government for any claims brought against it (i.e. operators are required to bear the risk of loss on behalf of the UK Government).²
2. In addition, Section 34 of the SIA states that operators have a strict liability to third parties (i.e. those who are not involved in launch activities do not need to prove fault to claim compensation for injury or damage caused by launch activities).³
3. The SIA grants the power to limit these two liabilities:
 - Section 12 (2) grants the power to limit an operator's liability to indemnify the UK Government.
 - Section 34 (5) grants the power to limit an operator's strict liability to third parties.
4. Finally, Section 38 of the SIA grants the power to make regulations that require licence holders, or other persons engaged in spaceflight activities, to be insured.
5. To clarify, the SIA (when it comes into force) regulates the procurement of a UK launch and the operation of a satellite from the UK. These activities do not benefit from liability limits until the proposed regulations are passed and any further regulatory approvals are secured. Even after the SIA comes into force, the procurement of an overseas launch and the operation of a space object by a UK entity based overseas will continue to be licensed and regulated by the Outer Space Act 1986 (OSA).⁴ These overseas activities will continue to benefit from a limited liability to indemnify the UK Government, currently set at €60m for standard missions launching overseas.⁵
6. This Impact Assessment (IA) assesses the draft Space Industry (Liabilities) Regulations and accompanying guidance. The remaining SIA Secondary Legislation and accompanying guidance is currently under consultation.⁶ Its accompanying Impact Assessment is referenced as the 'SIA Secondary Legislation IA' and is used as the basis for the Costs and Benefits section.⁷

1.2 Problem under Consideration

7. Where a UK entity procures a UK launch or operates a space object from the UK, they will hold an unlimited liability to indemnify Government for any claims brought against it and an unlimited liability to indemnify third parties for injury or damage (Figure 1).

¹ United Nations Office for Outer Space Affairs 'Convention on International Liability for Damage Caused by Space Objects', 1972 - available at: <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html>

² HM Government 'Space Industry Act', 2018 – available at: <http://www.legislation.gov.uk/ukpga/2018/5/contents/enacted>

³ This effectively brings the rights of domestic citizens in line with those of foreign nationals, who do not have to prove fault to claim compensation from Launching States under the UN Liability Convention.

⁴ HM Government 'Outer Space Act', 1986 – available at: <https://www.legislation.gov.uk/ukpga/1986/38/contents>

⁵ This was introduced following an amendment made by the Deregulation Act (HM Government 'Deregulation Act, Section 12', 2015 – available at: <http://www.legislation.gov.uk/ukpga/2015/20/section/12/enacted>).

⁶ HM Government 'Spaceport and Spaceflight Activities: regulations and guidance', July 2020 – available at: <https://www.gov.uk/government/consultations/spaceport-and-spaceflight-activities-regulations-and-guidance>

⁷ HM Government, 'Space Industry Regulations 2020 Impact Assessment', July 2020 - available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

8. Concerns about holding unlimited liabilities were raised in Parliament during debates on the Space Industry Bill. Concerns were also raised by industry in response to a March 2018 Call for Evidence, focusing on the availability and cost of unlimited insurance, and on industry exposure.⁸ Further independent, expert research was commissioned from Alden Legal Limited, Aon UK Ltd. and the Government Actuary's Department (GAD) to address these concerns. This research is referenced throughout the IA.
9. Based on externally commissioned report from Alden Legal, UK Government has concluded that limits on liability are critical to enabling commercially sustainable UK launch for the following reasons:
- All other major launch nations limit liabilities for launch activities from their territory (Annex 1).
 - The market does not and will not provide insurance for an unlimited liability. Even if the market did provide such cover, the cost would be prohibitively expensive (as insurers would need to hold sufficient capital to meet their liabilities).
 - Companies holding unlimited liabilities face difficulty raising finance.
10. Without a limit on the liabilities, launch operators have stated they will not launch from the UK, but rather from other nations where there are liability limits. This would undermine the UK Government's Commercial Spaceflight Programme and prevent it from achieving its intended objectives and benefits.
11. Figure 1 below displays the liabilities under consideration. UK entities procuring a UK launch or operating a space object from the UK hold two liabilities: firstly, a liability to indemnify Government for any claims brought against it and secondly, a strict liability to third parties for injury or damage.

Figure 1 Liabilities of UK entities procuring a UK launch and/or operating a space object from the UK

Licensed Activity	Liability to indemnify UK Government	Liability to third parties
Procuring a UK launch	The liability is stated in the SIA (Section 36, Section 34). The proposed Space Industry (Liabilities) Regulations would limit this liability, via licence conditions.	
Operating a space object from the UK	This liability is stated (and limited to €60m) in the OSA. It is proposed that the same policy applies for activities licensed under the SIA.	The liability is specified in the SIA. The proposed Space Industry (Liabilities) Regulations would limit this liability, via licence conditions.

12. This Impact Assessment focuses on launch liabilities: operators of space objects (or, orbital operators) liabilities are not included. Orbital operator liability to indemnify the UK government is not assessed here because the proposal is to extend OSA policy to licences granted under the SIA. This is effectively a continuation of the status quo.
13. It is proposed that orbital operator liability to third parties is limited at the same level as launch operator liability to third parties. This proposal is not assessed here because to make such a claim, two stringent criteria must be satisfied.⁹ Firstly, the space object (licensed under the SIA for UK launch) must survive re-entry. This is unlikely as UK launch focuses on small satellites which burn up in the atmosphere. Secondly, once through the atmosphere, the space object must land in UK territory (if it lands in any other territory, the claim will be made via indemnifying UK Government). Due to the exceptionally minute chance of both events happening, the expected impact of orbital operator liability to third parties is not quantified in this IA.

⁸ HM Government, 'Call for Evidence: Space Industry Act 2018 – Government Response', May 2019 - available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/804375/Government_Response_to_Call_for_Evidence_-_Spaceflight_Liabilities_-_Final_190528.pdf

⁹ Claims regarding orbital operator liability to third parties are made under SIA Section 34, relating to damage caused by re-entry of a space object.

1.3 Rationale for Intervention

14. Commissioned research concludes that the insurance market cannot supply insurance to cover unlimited liabilities: only cover up to c.\$500m (£382m) is available, whereas there is a hypothetical maximum financial loss of £4.5bn (accounted for in our modelling approach).^{10,11} This failure of the market to provide these higher levels of cover may be a result of:

15. Imperfect Market:

- There are few insurance providers with the necessary expertise and appetite for spaceflight insurance. Often, it is an extension of aviation, transport or telecommunications business and as such, it is secondary to prioritised core business areas.
- The limited number of insurance providers reduces the ability to form a sufficiently large risk pool. To reduce exposure from this limited pool, insurers limit the maximum cover offered.

16. Incomplete Information:

- There is a lack of UK launch operational experience. This lack of past evidence means the level of risk that insurance providers are exposed to is exceptionally hard to quantify. This uncertainty (of how risky the launch activity is) discourages insurance providers from entering the market due to business planning and risk management difficulties. A similar argument also applies to third-party losses arising from accidents. Such incidents are very rare and therefore modelling losses is very uncertain.
- This lack of evidence is not expected to change: initial UK launch forecasts are low. It will take many years before a robust evidence base is established.

17. Regulation

- Insurance providers are required by EU law to show they hold sufficient reserves to cover potential losses ('minimum capital requirements'). Although future UK law may differ in level, it is unlikely to abandon finite reserve requirements altogether (since they ensure insurance providers can meet at least a portion of their obligations to policyholders and claimants). Because of these finite reserve requirements, insurance providers cannot provide unlimited insurance cover whilst meeting industry regulation.

18. Over time, increases in launch volumes and available data could refine insurance premia and stimulate new insurance providers, mitigating the failure of the market to provide high levels of cover. However, even with operational experience, and higher levels of insurance cover available, the market is unlikely to provide unlimited liability cover. Limits on liabilities place an upper bound on potential claims to insurance providers, meaning they can hold sufficient reserves to cover potential claims and manage risk. Assuming insurance providers pass the cost reductions onto operators, liability limits reduce operator insurance costs, ensuring the UK launch market can compete with other launch nations, where liabilities limits are commonplace (Annex 1).

¹⁰ All conversions in this Impact Assessment are based on 24th January 2020 exchange rates, to be consistent with the 'SIA Secondary Legislation IA'. \$500m is equivalent to £382m at 3 significant figures.

(<https://www.bankofengland.co.uk/boeapps/database/Rates.asp?TD=24&TM=Jan&TY=2020&into=GBP&rateview=D>).

¹¹ This is based on the inflation-adjusted insured loss of the 1988 Piper Alpha oil-rig disaster; the worst offshore oil-rig disaster in terms of lives lost and industry impact (<https://www.lloyds.com/about-lloyds/history/catastrophes-and-claims/piper-alpha>). It is referenced here as the maximum insured financial loss relevant to UK spaceflight. Larger insured man-made losses have occurred such as the 2010 Deepwater Horizon oil spill which, as of 2018, cost BP more than \$65 billion in clean-up costs, penalties and legal fees

(<https://www.ft.com/content/ab8a602e-4d18-11e8-8a8e-22951a2d8493>,

<https://uk.reuters.com/article/uk-bp-deepwaterhorizon/bp-deepwater-horizon-costs-balloon-to-65-billion-idUKKBN1F5006>).

However, this incident is not considered as representative of a realistic level of loss for UK spaceflight.

1.4 Policy Objective

19. The objectives are to:

- Establish the necessary legislative and regulatory conditions to enable safe and sustainable spaceflight launch and associated activities from the UK.
- Create an internationally competitive regulatory regime so that launch operators enter the market and establish launch services.
- Enable the UK Government to comply with its international obligations under space treaties.¹²
- Ensure consistency across OSA and SIA licences, for both the procurement of launch and in-orbit activities.
- Ensures that any party suffering injury or damage has recourse to compensation.

1.5 Long List of Options Considered

20. Given the market will not be able to offer unlimited liability cover, it is assumed that operators will not launch while holding unlimited liabilities, and a limit on liabilities is required for UK commercially sustainable launch. This can only be established through regulations. As a result, no alternatives to regulation are included.

21. What follows are summaries of the options, varying according to the share of liability between Government and operator. At one extreme, there are no liability limits for launch activities and so the operator has full, unlimited liability (Option 1: Do Nothing, Option 4: Risk Pooling). At the other extreme is a full state guarantee (Option 5: Full State Guarantee). Two different methods of sharing liability are included (Option 2: Modelled Insurance Requirement, Option 3: €60m Fixed Limit). Finally, there is an option to charge for a partial or full state guarantee (Option 6: Premium for State Guarantee).

22. Options 1, 2 and 3 are taken forward for analysis. Options 4, 5 and 6 are discounted and not monetised: the reasons for this are explained below.

Option 1 (Counterfactual): Do Nothing

23. This is a continuation of the status quo. Operators continue to hold unlimited liabilities. It is assumed that no commercial spaceflight launch industry will develop in the UK.

Option 2 (Preferred): Modelled Insurance Requirement

24. The Modelled Insurance Requirement (MIR) sets the liability limit and the insurance requirement on a per launch basis, reflecting the risks of the specific launch (e.g. spaceport location, flightpath, launch vehicle type). It is based on the Maximum Probable Loss (MPL) approach used by Australia and the US.¹³ A state guarantee is provided to meet any claims in excess of the operator's liability limit.

25. This option aligns with the 'Minimum Viable Regulator' of the 'SIA Secondary Legislation IA'.¹⁴

¹² UN Liability Convention (United Nations Office for Outer Space Affairs 'Convention on International Liability for Damage Caused by Space Objects', 1972 - available at: <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html>).

¹³ Australian Government, 'Maximum Probable Loss Methodology', August 2019 - available at: <https://www.industry.gov.au/sites/default/files/2019-08/maximum-probable-loss-methodology-for-space-activities.pdf>

¹⁴ HM Government, 'Space Industry Regulations 2020 Impact Assessment', July 2020 - available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

Option 3: €60m Fixed Limit

26. The liability limit and the insurance requirement are fixed at €60m for each UK launch. This value is consistent with that used by many launch states.¹⁵ The Government will indemnify any claimants for claims in excess of the operator's liability limit.

Option 4: Risk Pooling

27. Members of a risk pool share are responsible for their combined financial risk, to limit each member's potential loss. To be effective, risk pooling requires lots of members (reducing each member's share of their combined financial risk).

28. However, there are few launch insurance providers, reducing the ability to pool high-risk launches (Rationale for Intervention). Furthermore, risk pooling does not necessarily enable unlimited cover. Thus, this option does not fix the incomplete market.

Option 5: Full State Guarantee

29. Under this option, the UK Government agrees to cover all losses arising from any spaceflight accident, with no insurance requirements placed on an operator.

30. Since commercial insurance is available on the market (albeit limited cover, rather than unlimited), a full state indemnity is excessive. Furthermore, with a full state guarantee, Government would be exposed to the full cost of any accidents. This does not incentivise lower risk missions, unlike Option 3 (where operators can benefit from lower risk missions through lower insurance premiums) and may exceed the Government's risk appetite.

Option 6: Premium for State Guarantee

31. A commercial-rate premium is charged for the provision of the state guarantee, as if the state was a private insurance provider.

32. Operators would have a further cost (over and above any insurance costs) to pay for the state guarantee. As other states do not charge for a state guarantee, this would likely reduce UK competitiveness and stunt UK launch demand, threatening the objectives of the Commercial Spaceflight Programme. If it is a full state guarantee, the arguments against such an approach from Option 5 apply. If the state guarantee were to be limited in some way, then such an approach would not be compliant with domestic Human Rights legislation, if there were no other recourse to compensation (i.e. which is unlikely, given the insurance market does not currently provided unlimited cover). This option would be challenging to deliver within the existing legislation.

1.6 Assessment of Shortlisted Options against Policy Objectives

Option 1: Do Nothing (Counterfactual)

33. The 'Do Nothing' option does not achieve our policy objectives. Without a state indemnity to claimants above liability limits, it is assumed that no commercial spaceflight launch industry will develop in the UK, as operators cannot gain unlimited insurance cover from commercial insurance markets (Problem under Consideration). Operators can launch from other states where there are liability limits. This is not preferred as it does not achieve the objectives of the Commercial Spaceflight Programme.

¹⁵ For a comparison of launch states' liability limits, see Annex 1.

Option 2 (Preferred): Modelled Insurance Requirement

34. Respondents to the Government's Call for Evidence preferred variation in liability limits to reflect risks associated with different types of launch.¹⁶ Under this option, the liability limit is derived from the risk profile of each mission, taking account of factors such as spaceport location, flightpath and launch vehicle type. This is based on the 'Maximum Probable Loss (MPL)' approach: an established model to limit launch liabilities in the US (where there is considerable experience of launch activity) and Australia.¹⁷ The approach is tailored to UK launch risks, the UK safety assessment and UK financial values (based on past compensation and current property prices) (Annex 2).
35. Risks of UK launches vary significantly due to the range of launch locations and operation types. Tailoring the liability limit and the insurance requirement to the risk level ensures insurance costs are appropriate. This enables lower risk operators to hold insurance requirements to reflect the lower risk of such operators. It also incentivises the reduction of risk in proposed missions (assuming insurance providers set lower premiums for missions with lower insurance requirements). Similarly, MIR delivers better outcomes for smaller operators, who are most sensitive to high insurance costs. For Government, MIR reduces the Government's contingent liability for high-risk missions (whenever the MIR exceeds €60m, the proposed limit of Option 3).
36. However, as the MIR is calculated for each launch, the modelling associated with the flight safety risk and the application of financial values to the outputs is more complex than Option 3. This will be the responsibility of the Regulator and derived from the outputs of the safety case, which will be provided by operators as part of the licensing process. These costs have been accounted for in the 'SIA Secondary Legislation IA', under 'Engagement Costs'. There will be no additional (engagement) costs to operators.
37. As no other European country has adopted a risk-based approach, there is no precedent for a potential state aid notification.

Option 3: €60m Fixed Limit

38. This simple approach is easy to deliver: the sterling equivalent of a €60m fixed limit is applied to every mission. It aligns with many other states, particularly in Europe.¹⁸ Furthermore, France received state aid approval (and re-approval) from the European Commission.¹⁹
39. However, a fixed limit means liability limits and insurance requirements do not reflect the risk of a mission. This is not appropriate for the UK launch market, which is expected to be predominantly small-satellite launches. Based on modelling to date, it is assumed that the expected losses will be significantly less than the €60m fixed limit. The relatively high fixed limit is therefore not proportionate to the level of loss anticipated by the MIR approach. Operators would have a higher liability limit than necessary and need to purchase excessive insurance cover. The fixed limit also effectively subsidises high-risk operators (given their disproportionately low insurance costs) and leaves the Government exposed to higher contingent liabilities.²⁰

¹⁶ HM Government, 'Call for Evidence: Space Industry Act 2018 – Government Response', May 2019 - available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/804375/Government_Response_to_Call_for_Evidence_-_Spaceflight_Liabilities_-_Final_190528.pdf

¹⁷ Australian Government, 'Maximum Probable Loss Methodology', August 2019 - available at:

<https://www.industry.gov.au/sites/default/files/2019-08/maximum-probable-loss-methodology-for-space-activities.pdf>

¹⁸ For a comparison of launch states' liability limits, see Annex 1.

¹⁹ European Commission 'State Aid Case 54927', October 2019 – available at:

https://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=3_SA_54927

²⁰ These contingent liabilities are limited by the fact that extremely high-risk mission profiles can prevent licence approval.

1.7 Preferred Option Summary and Implementation Plan

40. Option 2: Modelled Insurance Requirement is the preferred option and it is expected to be established prior to first launches in the early 2020s.
41. Safety is at the heart of our proposed regulatory regime under the Space Industry Act 2018. Launch from the UK is a new activity that presents new and different risks from those posed by traditional aviation and the experience of licensing procurement of launch activities from other states under the Outer Space Act 1986.
42. Under the Act the regulator has an overriding duty to exercise its functions with regard to spaceflight activities (including whether or not to grant a licence) with a view to securing public safety. This duty has primacy over the other matters that the regulator has to consider in exercising its functions.
43. It is proposed that the requirements for insurance will be set out in licence conditions. Further legislation is not required to do this due to the provisions in the SIA.²¹ However, further regulations are required to limit operator liability (included in draft in this consultation).
44. It is proposed that licence conditions will include:
- A liability limit (subject to securing the relevant regulatory, legal and Parliamentary approvals);
 - That licence holders (spaceport operators, range control service providers, launch and return operators and orbital operators) must hold or have access to a minimum level of insurance cover;
 - The liabilities that must be covered by a policy of insurance and prescribed exceptions where insurance will not be required;²²
 - Requirements on the provision of insurance documents to the regulator.
45. The Civil Aviation Authority (CAA) will regulate spaceflight activities. It will assess the safety of missions during the licensing process and, using the outputs of this assessment, calculate the insurance requirement.
46. The question of who sets the liability limit is still outstanding. One option is that the CAA sets the insurance requirement as described and additionally, recommends a liability limit. Another is that the Secretary of State sets the liability limit. This will be set out in the final stage IA.
47. Modelling will be refined over time, as operational experience increases. The financial values applied to potential losses will be reviewed at least every five years and updated in response to, for example, inflation, Personal Injury Discount Rate changes or economic downturns.

²¹ HM Government 'Space Industry Act', 2018 – available at: <http://www.legislation.gov.uk/ukpga/2018/5/contents/enacted>

²² It is proposed that applying the same waiver of insurance as currently applied under the OSA (for the lowest risk satellites, based on a risk assessment, launched from the International Space Station (ISS) or launched and operated in an orbit lower than the ISS).

2.0 Costs and Benefits

48. This Impact Assessment focuses on launch liabilities: operators of space objects (or, orbital operators) liabilities are not included (Problem under Consideration). All costs and benefits are estimated in 2020 prices and discounted to 2021 present values.^{23, 24} Costs and benefits are appraised over a 14-year appraisal period, 2020 to 2033 inclusive, to be consistent with the 'SIA Secondary Legislation IA'.^{25, 26}
49. This IA classifies costs and benefits in the same way as the 'SIA Secondary Legislation IA' (Figure 2). The main affected businesses are **launch operators** who enter the market via a licensing process which, under the preferred option, includes the specification of liability limit and insurance requirement. Launch operators may pass on some of their costs to **orbital operators** in raising the cost of procuring a launch, but given the lack of evidence on the size of this transfer, all compliance costs are assigned to launch operators.²⁷ The **Regulator** for commercial spaceflight launches will be directly involved in licensing entry to the market, including setting liability limits.
50. Additional relevant stakeholders for this legislation are the UK Government (**HMG**) and insurance providers (**Insurers**).

Figure 2 Legend for UK commercial spaceflight stakeholders and impacts²⁸

Stakeholder & Impacts Map		Spaceports	Range Control	Launch Operators	Orbital Operators	Regulator	Other Stakeholders
Benefits							
Costs to business	<u>Familiarisation costs</u>					No impact	
	<u>Engagement costs</u>	No impact	No impact	No impact	No impact		No impact
	<u>Compliance costs</u>	No impact	No impact		No impact	No impact	HMG
Non-business operations	<u>Justice impacts</u>	No impact	No impact	No impact	No impact	No impact	No impact
	<u>Accident investigation</u>	No impact	No impact	No impact	No impact	No impact	No impact
	<u>Liabilities</u>						
Wider Impacts	<u>Environment</u>						
	<u>Airspace</u>	No impact	No impact	No impact	No impact	No impact	No impact
	<u>Other impacts</u>					No impact	

51. There are areas where the evidence needs to be strengthened and assumptions tested through the consultation process. These areas are presented as questions in the consultation document published alongside this IA. Responses to these questions should enable a more accurate estimation of impacts in the final stage IA, before being laid alongside the final proposed secondary legislation in Parliament.

²³ Prices are adjusted for inflation so that all future and past values are in 2020 constant values, in line with HM Treasury Green Book rules – available at <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

²⁴ Present values mean the current value of a future stream of costs and benefits, discounted at a social discount rate of 3.5% in line with HM Treasury Green Book rules – available at: <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

²⁵ The start date was chosen due to the familiarisation costs incurred in 2020. The 14-year appraisal period captures long-term benefits (compared to the standard 10-year appraisal period) and is not any longer because of increasing uncertainty about the UK launch market forecasts over a longer time-period, compounded by Covid-19 (Annex 6). It also ensures consistency with analysis of the wider spaceflight programme's costs and benefits, conducted by London Economics Ltd on behalf of UK Space Agency in February 2020.

²⁶ HM Government, 'Space Industry Regulations 2020 Impact Assessment', July 2020 - available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

²⁷ Whilst those engaged in associated activities for launch (spaceport operators and range control operators) may have a claim made against them, it is assumed that third-party claims will be mostly against launch operators. Under current commercial practice, insurance is taken out by launch operators with other operators and parties to the launch (including spaceport, range control and orbital operators) named as additional insureds on a launch third-party liability policy.

²⁸ Based on the equivalent figure (Figure 4) in HM Government, 'Space Industry Regulations 2020 Impact Assessment', July 2020 - available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

2.1 Appraisal of Option 1: Do Nothing

52. This counterfactual scenario assumes the entire package of proposed SIA Secondary Legislation (not just the proposed SIA Secondary (Liabilities) Regulation) does not come into effect.²⁹ This avoids attributing the benefits of the entire Commercial Spaceflight Programme to one section of the legislation alone.

53. This section is drawn from the 'SIA Secondary Legislation IA'.³⁰

2.1.1 Assumptions and Evidence

54. Option 1: Do Nothing (Counterfactual): operators continue to hold unlimited liabilities and cannot gain unlimited insurance cover from commercial insurance markets.³¹ In line with the counterfactual in the 'SIA Secondary Legislation IA', the UK receives no additional benefits and incurs no additional costs related to UK launch.³²

55. London Economics' 'Size and Health of the UK Space Industry 2018' provides the most recent and detailed summary of UK-based space-related organisations.³³ It is used here to estimate the impact on the UK space industry in the absence of UK launch. Its findings **for 2016/2017** include:

- The UK space industry is made up of 948 organisations, with 39 new entrants per year since 2012. The industry directly contributed £5.7 billion of gross value added (GVA) to the UK economic output (Figure 4) (0.29% of UK GDP, up from 0.27% in 2014/15) and a total of £13.0 billion including supply chain effects.
- Total UK space industry income grew to £14.8 billion: a growth rate of 3.3% per annum (Figure 3). This is 5.1% of the global space economy (at 2016/17 exchange rates following the depreciation of GBP).
- Space Operations ("launch and/or operation of satellites and/or spacecraft") accounts for 15% of this income, compared to Space Applications (69%), Space Manufacturing (13%) and Ancillary Services (3%). This relatively low income for Space Operations supports the assumption that the UK launch industry would continue to not exist under this option.

56. The report also forecasted income growth of 4.8% to £15.5 billion in 2017/18 (after accounting for inflation).³⁴ GVA was forecasted to grow strongly (10.6%) to £6.3 billion in real terms.

²⁹ HM Government 'Spaceport and spaceflight activities: regulations and guidance', July 2020 – available at: <https://www.gov.uk/government/consultations/spaceport-and-spaceflight-activities-regulations-and-guidance>

³⁰ HM Government 'Space Industry Regulations 2020 Impact Assessment', July 2020 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

³¹ This does not include proprietary satellite ('space objects') operation activities, which are already licensed and regulated by the OSA.

³² HM Government 'Space Industry Regulations 2020 Impact Assessment', July 2020 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

³³ London Economics 'The Size and Health of the UK Space Industry 2018', January 2019 – available at: <https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2018>

³⁴ The 2017/18 forecast is sourced from London Economics analysis, based on survey respondents' forecasts and available annual reports.

Figure 3 UK Space Industry Income, 1999/00 - 2017/18³⁵

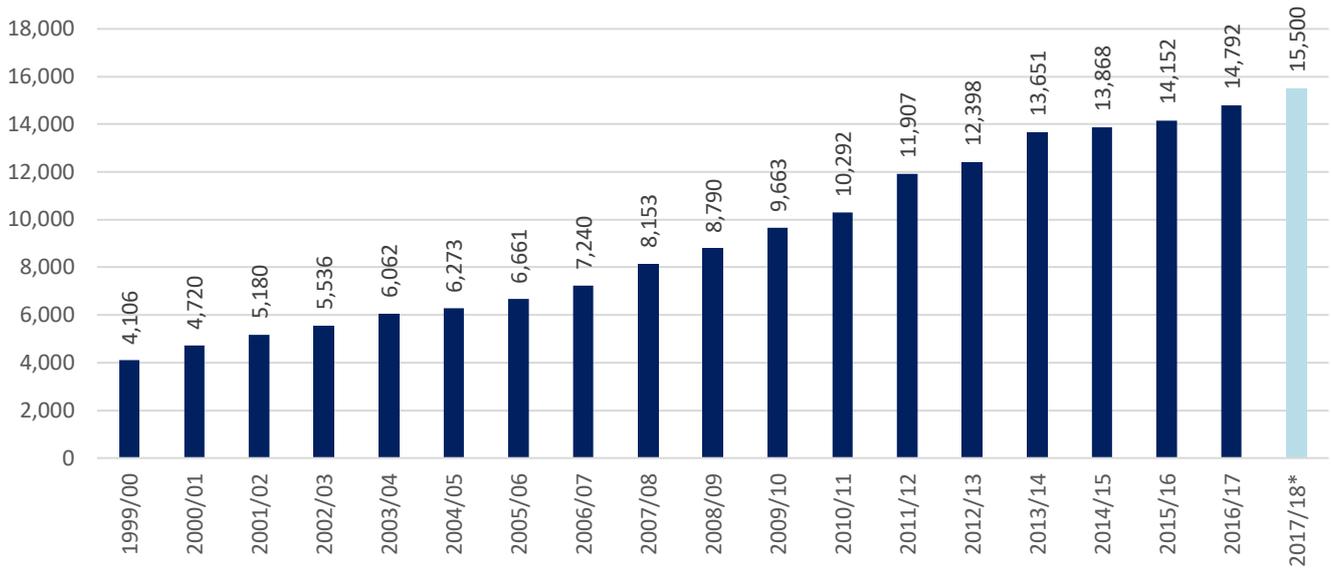
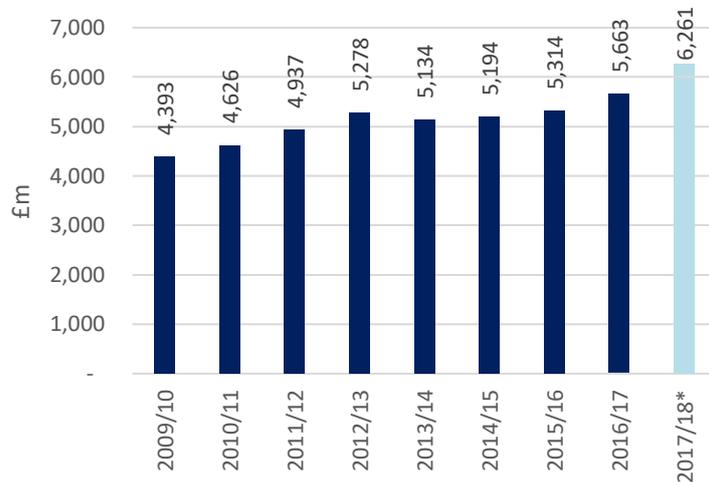


Figure 4 UK Space Industry Gross Value Added, 2009/10 - 2017/18³⁶



2.1.2 Results

57. Without liability limits, the entire package of proposed SIA Secondary Legislation is incomplete and the benefits of UK launch activities are not realised. Currently, all UK satellites are launched from abroad so the GVA of UK satellite launch is captured by other nations. This would continue: there would be no commercial benefits to UK spaceports, range control service providers or launch operators or to the wider space industry (Benefits Assumptions and Evidence). Furthermore, at a global market level, the demand for small satellites is forecasted to outstrip launch supply over the next decade.³⁷ In this counterfactual scenario, the UK would not capture the benefits of this increasing launch demand.

58. Alongside not capturing certain benefits, there is a risk that inaction reduces the UK space sector's competitiveness, leading to a loss of global market share. Although the UK space industry is predicted to grow, without a UK launch industry it is unclear whether businesses that are upstream or

³⁵ London Economics 'The Size and Health of the UK Space Industry 2018', January 2019 – available at: <https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2018>

³⁶ London Economics 'The Size and Health of the UK Space Industry 2018', January 2019 – available at: <https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2018>

³⁷ Frost & Sullivan 'UK Spaceport Business Case Evaluation', 2018 – available at <https://www.gov.uk/government/publications/evaluation-uk-spaceport-business-case>

downstream of launch activities would be able to compete with their equivalents in launch nations. For example, a lack of UK launch capability is likely to affect the UK small satellite industry.

59. As described in the ‘SIA Secondary Legislation IA’, even without the entire package of SIA Secondary Legislation, there are still the benefits of Commercial Spaceflight Programme expenditure. These are the **expenditure** effects and **knowledge spillovers** from public and private investment in the launch industry (Benefits Assumptions and Evidence).³⁸

2.2 Appraisal of Option 2: MIR and Option 3: €60m Fixed Limit

60. Liability limits contribute to enabling UK launch activities. However, they cannot enable UK launch activities on their own: only as a complete package does the proposed secondary legislation and guidance enable UK launch.³⁹ Therefore, all the benefits (and costs) of UK launch activities cannot be attributed to liabilities and insurance legislation alone.

61. As both options limit operator liabilities, enabling launch activities in the UK, there are no additional quantified benefits for either option. What is quantified here is the additional cost of each proposed option, over and above the costs in the ‘SIA Secondary Legislation IA’.⁴⁰

2.2.1 Benefits Results

62. The ‘SIA Secondary Legislation IA’ calculated the benefits of enabling UK launch activities under various scenarios.⁴¹ As an element of this legislation, the Options would help realise these benefits, presented in Table 1 below.

Table 1: Total benefits of UK launch under Minimum Viable Regulation 2020-33 (£m), 2020 prices and 2021 present values

Benefits of UK launch (£ million)	Low	Central	High
<i>Leveraged effects</i>			
Leveraged effects: direct GVA	£0	£114	£1,076
Leveraged effects: indirect GVA	£0	£62	£592
Leveraged effects: induced GVA	N/Q	N/Q	N/Q
Total leveraged effects	£0	£176	£1,668
Growth effects	£0	£92	£129
Tourism benefits		£0.4	£2.6
Total benefits of UK launch	£0	£268	£1,799

63. No additional benefits (over and above those calculated in the ‘SIA Secondary Legislation IA’) are expected to be realised by these options. Therefore, the benefits of the liabilities and insurance legislation alone remain Not Quantified (Summary: Analysis & Evidence).

64. Although not quantified for methodological reasons, it is thought that Option 3: €60m Fixed Limit will weaken launch demand, reducing Leverage and Tourism benefits in particular.⁴² Further detail on the results in Table 1 and the potential impact of Option 3 is included in the section below.

³⁸ One example of public and private investment in the launch industry is the investments already made in the 7 proposed spaceports in the UK.

³⁹ HM Government ‘Spaceport and spaceflight activities: regulations and guidance’, July 2020 – available at: <https://www.gov.uk/government/consultations/spaceport-and-spaceflight-activities-regulations-and-guidance>

⁴⁰ HM Government ‘Space Industry Regulations 2020 Impact Assessment’, July 2020 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

⁴¹ *Ibid.*

⁴² The ‘SIA Secondary Legislation Impact Assessment’ takes launch demands to be exogenous. Adjusting the launch demands according to an Option would endogenise them, making this analysis inconsistent with the analysis of all other Secondary Legislation. In order to ensure consistency, the launch forecasts are assumed to be exogenous here. Expected adjustments are discussed and presented as illustrations..

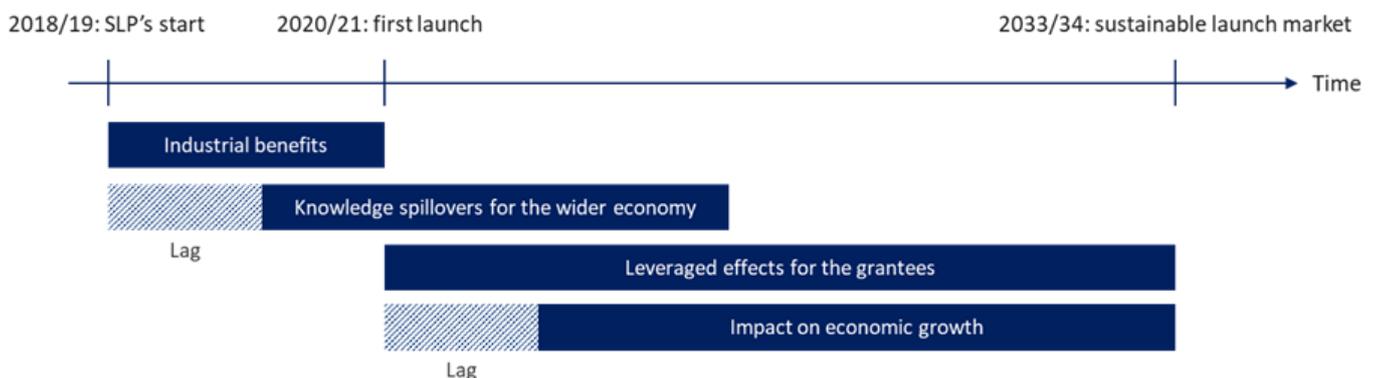
2.2.2 Benefits Assumptions and Evidence

65. The benefits of enabling UK launch activities are categorised as (Figure 5):

- **Expenditure effects:** the income and employment impacts of (public and private) investment.
- **Knowledge spill-over effects:** the economic benefits of (public or private) investments in research and development, as the knowledge proliferates into the wider economy.
- **Leveraged effects:** the GVA of operators' UK launch activities.
- **Growth effects:** any downstream space industry growth as a result of UK launch activity, such as satellite operators that take advantage of domestic launches.⁴³

66. **Industrial** and **knowledge spill-over** effects happen regardless of UK launch activities, so are not attributed to any of the SIA Secondary Legislation. **Leveraged** and **growth** effects are only achieved if there is successful UK launch. These latter benefits are attributed to the SIA Secondary Legislation (of which the proposed SIA Secondary (Liabilities) Regulation is a part) and are calculated in the 'SIA Secondary Legislation IA'.⁴⁴

Figure 5 Visualisation of the benefits associated with the Commercial Spaceflight Programme over time⁴⁵



Leveraged Effects

67. Leverage effects fall into three categories:

- **Direct effects:** the GVA added to operators from their launch activity.⁴⁶
- **Indirect effects:** the GVA to the supply chain from operators' launch activity.^{47, 48}

⁴³ Benefits to upstream segments are not included since this would likely result in double counting leveraged effects.

⁴⁴ HM Government 'Space Industry Regulations 2020 Impact Assessment', July 2020 – available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

⁴⁵ Categorisation of benefits completed by review of UKSA documentation by London Economics in 2019.

⁴⁶ London Economics 'The Size and Health of the UK Space Industry 2018', 30 January 2019 – available at:

<https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2018>

⁴⁷ *Ibid.*

⁴⁸ The results are broadly consistent with those of the aviation and aerospace sectors, where aviation multipliers are based on DFT internal analysis of ONS input-output tables and aerospace multipliers are based on Aerospace Technology Institute (ATI) analysis of 'The Economic Impact of UK Aerospace Industrial Strategy', October 2017, available at:

<https://www.atl.org.uk/media/szgojd4w/insight04-the-economics-of-aerospace-the-economic-impact-of-uk-aerospace-industrial-strategy.pdf>

- **Induced effects** the GVA to the wider economy from operators' launch activity. These effects are not quantified as they are not recommended by HM Treasury guidance.⁴⁹

68. Option 2: Modelled Insurance Requirement is assumed to be accessible for all operators. With no impact on forecasted demand, this option is expected to secure the leverage effects in Table 1. Option 3: €60m Fixed Limit applies to all mission types. The higher insurance requirement for small and low-risk operators (compared to Option 2: Modelled Insurance Requirement) is expected to raise their insurance costs, making some forecasted launches unviable. A reduced launch demand means leverage effects would be lower than those presented in Table 1, with a higher degree of uncertainty.

Growth Effects

69. Growth effects are any downstream space industry growth as a result of UK launch activities. The effects were calculated by London Economics assuming an income uplift of 0% (Low scenario), 1% (Central) or 1.4% (High scenario) in the relevant sectors of the space industry (Annex 4).⁵⁰

70. With no impact on forecasted demand, Option 2: Modelled Insurance Requirement is expected to secure the growth effects in Table 1. In making some forecasted launches unviable, Option 3: €60m Fixed Limit is expected to restrict the growth in the downstream, reducing the growth effects to below those presented in Table 1 and introducing a higher degree of uncertainty.

Tourism Effects

71. Tourism effects assume an expected number of visitors per launch (45 visitors per vertical launch and 25 visitors for horizontal launch).⁵¹

72. With no impact on forecasted demand, Option 2: Modelled Insurance Requirement is expected to secure the tourism effects in Table 1. In making some forecasted launches unviable, Option 3: €60m Fixed Limit reduces the number of launches for tourists to attend, reducing the tourism effects to below those presented in Table 1 and introducing a higher degree of uncertainty.

2.2.3 Illustrative Change in Benefits under Option 3: €60m Fixed Limit

73. With higher insurance requirements for low-risk missions and associated higher insurance costs, Option 3: €60m Fixed Limit is expected to make some launches unviable. To illustrate the effect of restricted demand on the forecasted benefits, Table 2 presents the change in benefits that comes from losing sub-orbital launches. These low-risk missions are the most likely to be affected by disproportionate insurance requirements.⁵²

⁴⁹ HM Treasury 'The Green Book', July 2020 – available at:

<https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

⁵⁰ HM Government 'Space Industry Regulations 2020 Impact Assessment', July 2020 – available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

⁵¹ *Ibid.*

⁵² Compared to the 'SIA Secondary Legislation IA', there is one further assumption that the effect on the downstream (growth effects) of removing sub-orbital launch is negligible. The justification is that sub-orbital launches do not carry satellites. All growth effect segments explicitly reference satellites, except 'Supply of user devices and equipment' (Annex 4), which is itself predominately satellite manufacture.

Table 2 Change in the benefits of the Commercial Spaceflight Programme, with sub-orbital demand removed⁵³

Benefits of UK launch (£ million)	Low	Central	High
<i>Leveraged effects</i>			
Leveraged effects: direct GVA	£0	-£15 (-13%)	-£130 (-12%)
Leveraged effects: indirect GVA	£0	-£8 (-13%)	-£71(-12%)
Leveraged effects: induced GVA	N/Q	N/Q	N/Q
Total leveraged effects	£0	-£23 (-13%)	-£201(-12%)
<i>Growth effects</i>			
Growth effects	£0	£0 (-0%)	£0 (-0%)
Tourism benefits	£0	-£0.1 (-24%)	-£0.6 (-22%)
Total benefits of UK launch	£0	-£23 (-9%)	-£202 (-11%)

2.2.4 Costs Results

74. The total cost of Option 2: Modelled Insurance Requirement and Option 3: €60m Fixed Limit are presented in Table 3 and Table 4 below. The main difference is due to compliance costs. Option 3 and its associated insurance costs to operators are estimated to be 2.5 times larger than the equivalent for Option 2. Further options analysis is presented below (Summary).

Table 3 Total Cost of Option 2: MIR between 2020-2033 (£,000), 2020 prices and 2021 present values

Option 2: MIR Costs		Direct Costs (£'000)						Indirect Cost (£'000)	Total cost (£'000)	Total cost (£'000)
		Spaceport	Range	Launch	Orbital	Regulator	HMG			
Transition Costs	Familiarisation	£28	£16	£66	£89	-	-	£375	£575	£587
	Engagement	-	-	-	-	£12	-	-	£12	
	Compliance	-	-	-	-	-	-	-	£0	
Average Annual Costs	Engagement	-	-	-	-	£20	-	-	£20	£101
	Compliance	-	-	£81	-	-	£0.54	-	£81	
	Other	-	-	-	-	-	-	-	£0	
Total Cost for 2020-2033 (£,000)		£28.4	£16.3	£1,116.7	£89.4	£276.3	£7.0	£375.0	£1,909.2	

Table 4 Total Cost of Option 3: €60m Fixed Limit between 2020-2033, 2020 prices and 2021 present values

Option 3: Fixed Limit Costs		Direct Costs (£'000)						Indirect Cost (£'000)	Total cost (£'000)	Total cost (£'000)
		Spaceport	Range	Launch	Orbital	Regulator	HMG			
Transition Costs	Familiarisation	£20	£12	£47	£63	-	-	£266	£408	£408
	Engagement	-	-	-	-	£0	-	-	£0	
	Compliance	-	-	-	-	-	-	-	£0	
Average Annual Costs	Engagement	-	-	-	-	£0	-	-	£0	£342
	Compliance	-	-	£342	-	-	£0.02	-	£342	
	Other	-	-	-	-	-	-	-	£0	
Total Cost for 2020-2033 (£,000)		£20.2	£11.5	£4,493.3	£63.5	£0.0	£0.3	£266.3	£4,855.0	

2.2.5 Costs Assumptions and Evidence

Direct costs to business

75. This legislation only imposes direct costs on potential licence applicants, actual licence applicants and licence holders that willingly decide to enter the UK launch market. There are three types of cost in the

⁵³ Sourced from UKSA's Spaceflight Cost Benefit Analysis Model, Version 3.3, adjusted by removing sub-orbital launches from launch forecasts

‘SIA Secondary Legislation IA’.⁵⁴ Businesses that familiarise themselves with the proposed legislation and accompanying guidance, before deciding whether or not to enter the launch market, incur direct **familiarisation costs**. Businesses that enter the launch market incur the direct **compliance** and **engagement costs** associated with the regulatory licensing and monitoring process.

Direct costs to business: Familiarisation

76. This is the direct cost to businesses that familiarise themselves with the legislation and accompanying guidance before deciding whether or not to enter the launch market.⁵⁵
77. Familiarisation costs are estimated using ‘SIA Secondary Legislation IA’ methodology, based on Regulatory Policy Committee (RPC) guidance.⁵⁶ The expected number of licence applicants (and other interested stakeholders) are multiplied by the expected time taken to read. This can be thought of as the proportion of a single full-time equivalent (FTE) employee needed to read. This is multiplied by the number of in-house employees expected to read the legislation (such as lawyers) and accompanying guidance (such as managers, engineers, and finance professionals) and their associated wage and non-wage costs.
78. The expected number of licence applicants and other interested stakeholders is taken from London Economics’ ‘Size and Health of the UK Space Industry 2018’ and the Knowledge Transfer Network’s Space Landscape online tool (Annex 3).^{57,58}
79. The expected time taken to read is derived from Better Regulation Framework (BRU) guidance about reading speeds (words per minute) for technical documents and the assumption that technical documents need to be read 3 times to be properly understood (Table 5).⁵⁹ The length of the secondary legislation and guidance (Table 6) is divided by these reading speeds to estimate the time (in minutes) to read.

Table 5 Reading assumptions

	Low	Central	High
Reading speed (words per minute)	100	75	50
Times read	3	3	3

Table 6 Length of documents

Document	Number of words	
	MIR	Fixed Limit
Secondary legislation	641	1,600
Guidance	15,698	10,000

⁵⁴ HM Government ‘Space Industry Regulations 2020 Impact Assessment’, July 2020 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

⁵⁵ Businesses with no intention of holding a licence but are interested in understanding the UK launch market incur indirect familiarisation costs. This includes launch insurance providers and is quantified.

⁵⁶ Regulatory Policy Committee ‘RPC short guidance note – implementation costs’ August 2019 – available at: <https://www.gov.uk/government/publications/rpc-short-guidance-note-implementation-costs-august-2019>

⁵⁷ London Economics ‘Size and Health of the UK Space Industry 2018’, 30 January 2019 – available at: <https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2018>

⁵⁸ Knowledge Transfer Network ‘Space Sector Landscape’, accessed 15 November 2019 – available at <https://space.ktnlandscapes.com/>

⁵⁹ HM Government ‘Business Impact Target: Appraisal of Guidance’, April 2017 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/609201/business-impact-target-guidance-appraisal.pdf

80. The type and number of in-house employees (or externally procured expertise) expected to read the secondary legislation and accompanying guidance is based on expert advice from UKSA, DfT and CAA. The assumptions used are shown in Annex 5.
81. The wage costs of prescribed roles (Annex 5) have been estimated using salary information from aerospace and defence sector job advertisements and generic occupation earnings information from the 2018 Annual Survey of Hourly Earnings (ASHE). A low and high estimate have been used where available and estimated by +/- 25% where not available. An uplift of 26.5% has been applied to represent non-wage labour cost such as national insurance and employer pension contributions in each case.⁶⁰

Direct costs to business: Engagement

82. This is the direct cost to licence applicants and holders of, engaging with the regulator during the licence application process and monitoring regime, respectively. It is assumed that all information required to set the liability limit and insurance requirements (for either Option) is provided by the operator as part of the safety case, and hence this engagement cost is accounted for in the 'SIA Secondary Legislation IA'.⁶¹ On this basis, there are no (additional) engagement costs to business from this legislation.
83. Additional, non-monetised engagement costs include the uncertainty of an operator's financial plans under Option 2: Modelled Insurance Requirement. The guidance will not contain sufficient information to derive a precise modelled insurance requirement due to commercial sensitivity concerns, but it will be transparent on the method. Once there is sufficient operational experience, it would be possible to estimate the likely range of modelled insurance requirements.

Direct costs to business: Compliance

84. This is the direct cost to licence holders of complying with regulations. To comply with this legislation, spaceflight operators must purchase insurance.
85. It is assumed that insurance providers break-even: the price of insurance equals the expected damage plus the administrative cost of insurance. Therefore in purchasing insurance, spaceflight operators internalise the cost of their expected damages to society. This is a direct cost to business.⁶² In purchasing insurance, spaceflight operators also cover the administrative costs of insurance. This is a further direct cost to business, which is transferred from insurance providers to operators through higher insurance premiums.
86. Based on externally commissioned advice, it is assumed that insurance prices are 0.1% of the insurance limit purchased. This is based on using broad assumptions, including that the technology is well proven as a baseline scenario for modelling purposes, so this may not reflect the bespoke nature of many space programmes. Also, sensitivity scenarios of +/- 20% on insurance prices are included, to reflect that third-party liability insurance prices had increased by 20% over 2019.⁶³

⁶⁰ Department for Transport 'Transport Analysis Guidance: A4.1 Social Impact Appraisal', May 2019 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/805253/tag-4.1-social-impact-appraisal.pdf

⁶¹ HM Government 'Space Industry Regulations 2020 Impact Assessment', July 2020 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

⁶² The baseline assumption is that without these regulations, there would be no market at all. Therefore, in introducing a market, we introduce the direct expected cost of accidents. In purchasing insurance, the expected cost on society is effectively transferred to business and so there is no change to the NSPV.

⁶³ Internal commissioned research from Aon UK Ltd. indicates that the space insurance market is closely aligned with the aviation market, and large claims within the aviation sector are the main driver of these increases.

87. Using illustrative Modelled Insurance Requirements for two illustrative sites (Site A and Site B) derived by UK Space Agency’s Chief Engineer’s Team, and assuming insurance would be purchased to cover the entire Fixed Limit, a per-launch insurance cost is calculated for each illustrative site. Scaling these estimates by the launch forecasts (Annex 6) provides an estimate for the annual insurance cost to operators.
88. Given a lack of operational data on how much of this cost is transferred from launch operators to orbital operators, the costs are not broken down by operator type but rather assumed it would be paid by launch operators.

Indirect costs to business

89. Businesses with no intention of holding a licence but interested in understanding the UK launch market incur indirect familiarisation costs.⁶⁴ This includes launch insurance providers and is quantified using the same method as Direct costs to business: Familiarisation.
90. As in the ‘SIA Secondary Legislation IA’, the other indirect costs are those that “occur outside safe and compliant launch activities”.⁶⁵ This includes the cost of accidents as a result of unsafe or non-compliant activities. Given unsafe or non-compliant activities are likely to contravene a licence condition, or a part of the SIA or its regulations, the impact of the accident on operators can be ignored under HM Treasury guidance to ignore the impact on law-breaking businesses. The remaining costs of accidents as a result of unsafe or non-compliant activities are accounted elsewhere: the cost of investigation is included in ‘SIA Secondary Legislation IA’ and the cost of third-party injury and loss is included in this IA (in the insurance costs, see Direct costs to business: Compliance).

Regulator costs

91. The regulator for commercial spaceflight launches from the UK will be directly involved in licensing entry to the market and monitoring compliance with licence conditions. It has two additional functions under this legislation. These are:
- **Transitional** development of the model for setting Modelled Insurance Requirements.
 - **Ongoing** setting of the Modelled Insurance Requirement for each relevant licence.
92. The expected time taken for each of these functions has been estimated by UKSA (Table 7). It is assumed that each launch needs a specific assessment and that ongoing costs remain constant. However, it is likely that some launches will be similar to those performed before, so additional modelling will be either lower or not required. These estimates are therefore conservative.

Table 7 Regulator time cost assumptions

	Fixed Limit	MIR
Upfront Model Development	None	50 working days
Ongoing MIR Assignment	None	10 working days per relevant licence

93. These time costs were transformed into financial costs using the associated wage and non-wage costs of those expected to be responsible for each function (based on UKSA October 2018 payroll).

⁶⁴ Regulatory Policy Committee ‘RPC short guidance note – implementation costs’ August 2019 – available at: <https://www.gov.uk/government/publications/rpc-short-guidance-note-implementation-costs-august-2019>

⁶⁵ HM Government ‘Space Industry Regulations 2020 Impact Assessment’, July 2020 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

Table 8 Regulator wage cost assumptions

	Performed by UKSA Grade Equivalent	Average Annual Cost plus bonus (£)	Total Planning Rate
Upfront Model Development	SEO	47,445	62,945
Ongoing MIR Assignment	Grade 7	66,933	82,433

94. These ongoing financial costs are turned into annual costs using the launch forecasts for the appraisal period (Annex 6). Finally, the upfront cost was added in the year 2020 and 25% optimism bias is applied to produce the final cost (in 2020 prices and discounted to 2021 present value). This method is consistent with the ‘SIA Secondary Legislation IA’, where these costs would be classified as additional licensing costs for launch operator licences to the ‘minimum viable’ regulator.⁶⁶

95. It is assumed that there is 100% compliance with the proposed secondary legislation. Therefore the costs of negligence, wilful misconduct or non-compliance with licence conditions or regulations are not included in the total costs and benefits.

96. In the long-term, the cost of regulating the UK launch market is expected to be recovered from the UK launch industry, in line with HM Treasury’s ‘Managing Public Money’ guidance.⁶⁷ The UKSA intend to re-engage with industry on this issue when a position on charging has been agreed by the UK Government. This will be updated in the final stage IA if new information is available.

Costs to UK Government

97. A limit on an operator liability acts as a risk-share between the operator and HM Government. The level of the limit determines the balance of risk between the operator and HMG, assuming our estimate of worst-case scenario costs are reasonable. For any limit, there is a (however remote) possibility of an accident causing even more damage than accounted for in the operator’s insurance requirement. This possibility means that a limit on operator liability gives Government a contingent liability.

98. It is not possible to accurately define the contingent liability to Government: launch rates and types are undetermined, as are the accidents. A probabilistic assessment is required. To enable modelling, a financial loss upper-limit of £4.5 billion is assumed (based on the insured loss of the 1988 Piper Alpha oil-rig disaster).⁶⁸ For a given launch, Government liability is defined as the difference between the operator’s liability and this worst-case scenario.

99. Here, in line with HM Treasury approval processes, this contingent liability is expressed as the Expected Cost to Government per launch, provided by the UK Space Agency’s Chief Engineer’s Team. This is the cost (per launch) that the Government would be expected to pay out over a very large number of identical launches (specifically, 10 million launches). A per-launch cost is used to enable calculations within the appraisal period. In practice, this cost is not realised on a per-launch basis, but realised as one or two costs spaced randomly across approximately 1 million years (at 10 launches per annum).

100. This Expected Cost to Government per launch has been multiplied by the launch forecasts (Annex 6) to give an annual cost.

⁶⁶ HM Government ‘Space Industry Regulations 2020 Impact Assessment’, July 2020 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

⁶⁷ HM Treasury ‘Managing Public Money’, 1 October 2019 – available at: <https://www.gov.uk/government/publications/managing-public-money>

⁶⁸ The Piper Alpha oil-rig disaster is the worst offshore oil-rig disaster in terms of lives lost and industry impact (<https://www.lloyds.com/about-lloyds/history/catastrophes-and-claims/piper-alpha>). It is referenced here as the most expensive insured loss relevant to UK spaceflight.

Note on Insurance Providers

101. In line with the ‘SIA Secondary Legislation IA’ and RPC guidance, the familiarisation costs incurred by wider industry are indirect.⁶⁹ The cost of insurance providers familiarising themselves with the legislation and guidance is included in the Indirect Familiarisation figure.
102. Assuming insurance providers break even, they charge a premium equal to the expected damages and the administrative costs of insurance. Both costs are recuperated through charging spaceflight operators an insurance premium (Direct costs to business: Compliance).

Wider economic impacts

103. Finally, we include wider impacts on the UK launch insurance market, assessing the size of UK insurance providers as well as market competitiveness.

2.3 Summary

104. The results of the analysis are presented in Table 9 below. The values in bold are those recorded in the Summary: Analysis & Evidence sheets for each Option.

Table 9 Costs and benefits of Option 2 and 3 between 2020-2033, 2020 prices and 2021 present values

Scenario		Low		Medium		High	
		MIR	Fixed Limit	MIR	Fixed Limit	MIR	Fixed Limit
Option Costs							
Transition Costs (2020/21) (£,000)	Familiarisation (Operators)	£101	£71	£200	£142	£474	£336
	Familiarisation (Industry)	£206	£147	£375	£266	£796	£565
	Engagement (Regulator)	£14	£0	£15	£0	£17	£0
Total Transition Costs (2020/21) (£M)		£0.321	£0.218	£0.590	£0.408	£1.286	£0.901
Average Annual Costs (excl. Transition) (£,000)	Engagement (Regulator)	£10	£0	£20	£0	£118	£0
	Compliance (Operators)	£19	£201	£81	£342	£677	£1,806
	Compliance (Government)	£0	£0	£1	£0	£3	£0
Total Average Annual Costs (excl. Transition) (£M)		£0.029	£0.201	£0.101	£0.342	£0.797	£1.807
Total Cost over 14 year Appraisal Period (£M)		£0.70	£2.84	£1.91	£4.86	£11.65	£24.39

105. Option 2: Modelled Insurance Requirement has higher familiarisation costs (both directly to operators and indirectly to wider industry) due to the more complex process and having longer accompanying guidance. Option 2 also has higher engagement costs, as only this option requires additional effort from the Regulator. However, these differences are dwarfed by the difference in compliance costs. Option 3: Fixed Limit and its associated insurance costs to operators are estimated to be 2.5 times larger than the equivalent for Option 2.

⁶⁹ Regulatory Policy Committee ‘Business Impact Target specific issues: direct versus indirect impacts’, 1 March 2019 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/790016/RPC_case_histories_-_direct_and_indirect_impacts_March_2019_1.pdf

2.3.1 Business Impact Target Calculations

106. Figure 14 shows which impacts this IA has quantified and how the Equivalent Annual Net Direct Cost to Business (EANDCB) has been calculated, including justifications for impacts that have been included or excluded from these metrics. Note, that given benefits are not quantified, this is effectively Equivalent Annual Direct Cost to Business.

Figure 6: Summary of quantified impacts and calculations

Impact	Quantified	EANDCB	NPSV	Justifications for inclusion/exclusion
Benefits				
<u>Leveraged effects</u>				
Direct GVA	No	No	No	Not Quantified to avoid double counting alongside the 'SIA Secondary Legislation IA'.
Indirect GVA	No	No	No	
Induced GVA	No	No	No	
<u>Growth effects</u>	No	No	No	
<u>Tourism benefits</u>	No	No	No	
Costs				
<u>Regulator costs</u>				
<u>Licensing</u>	Yes	No	Yes	Direct public cost of regulating the market, long-run ambition for cost-recovery in line with HMT guidance. No monitoring costs associated with this proposed Regulation.
<u>Monitoring</u>	N/A	N/A	N/A	
<u>Familiarisation costs</u>	Yes	Yes	Yes	
<u>Engagement costs</u>				
<u>Licensing</u>	N/A	N/A	N/A	There are no direct business costs of engaging with regulator (during licence application or licensee monitoring process) associated with this proposed Regulation.
<u>Monitoring</u>	N/A	N/A	N/A	
<u>Compliance costs</u>				
<u>Prescribed roles</u>	N/A	N/A	N/A	No hiring of prescribed roles associated with this proposed Regulation.
<u>Others</u>	Yes	Yes	Yes	Direct cost to business of insurance, which equals the expected cost of damage plus admin.
<u>Justice impacts</u>	No	No	No	Excluded, HMT guidance assumes full compliance with regs
<u>Accident investigation</u>	N/A	N/A	N/A	Excluded, limited evidence and HMT full compliance assumption
<u>Liabilities</u>	N/A	N/A	N/A	Limited evidence, excluded because not quantified (NQ)
<u>Environment</u>	No	No	No	Significant uncertainty and only partially quantified so excluded.
<u>Airspace</u>	No	No	No	Limited evidence, excluded because not quantified (NQ)
<u>Other impacts</u>				
<u>SaMBA</u>	No	No	No	Limited evidence, excluded because not quantified (NQ)
<u>Competition</u>	No	No	No	
<u>Innovation</u>	No	No	No	
<u>Trade</u>	No	No	No	

2.3.2 Sensitivity Analysis

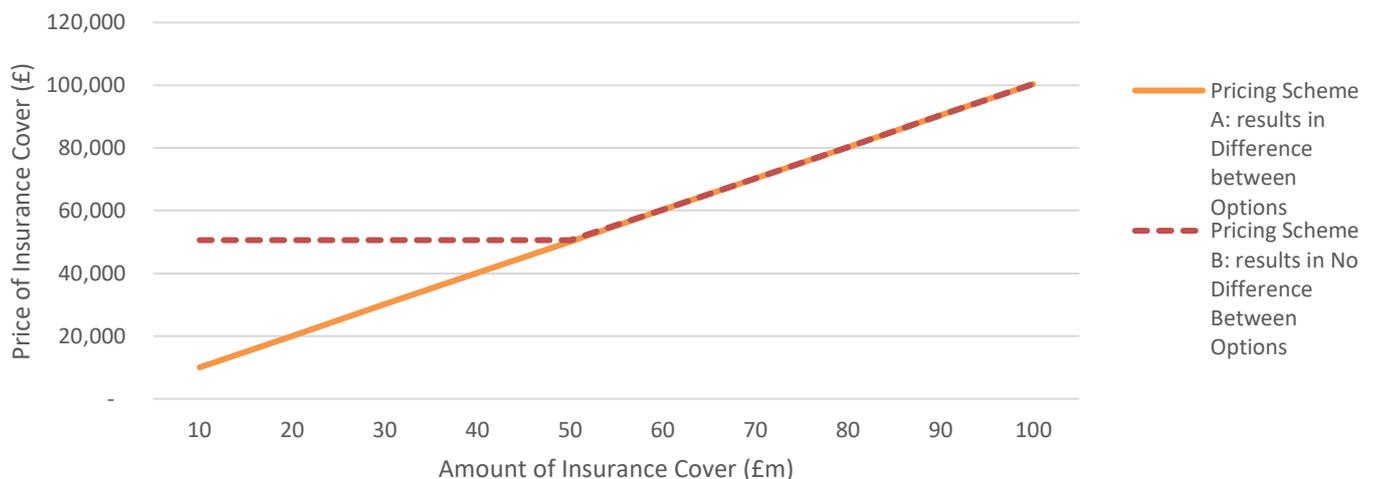
107. This IA uses the best available evidence, and clearly states any assumptions that have been made in the absence of evidence. There is a large amount of uncertainty about how the commercial spaceflight market might develop in the UK. Therefore, this IA presents low, central and high scenarios based on the following variables:

- **Market forecasts** – varying according to the number of businesses and launch frequencies. This includes horizontal and vertical launches, and sub-orbital and orbital missions, but does not yet include the impacts of Covid-19 on timescales, which will be tested through consultation.
- **Unit costs and benefits** – this includes market prices for insurance premiums, reading speeds and wage costs associated with various public and private sector activities.

108. The assumptions used and the results of these scenarios have been presented in the relevant Costs and Benefits section of this IA.

109. In this section, there is additional analysis on insurance costs. It demonstrates that in order for there to be any difference in Operator Compliance costs between Option 2: Modelled Insurance Requirements and Option 3: Fixed Limit, insurance prices must be lower for insurance cover less than (the GBP equivalent of) €60 million. The graph below (Figure 6) demonstrates the difference in pricing schemes.

Figure 7 Insurance Pricing Schemes Scenarios



110. Modelling insurance requirements means that insurance requirements can be set lower than the standard €60 million of Option 3 (to reflect lower anticipated levels of loss included within the 1 in 10 million threshold for UK launches). However, if insurance prices do not vary significantly with the amount of cover purchased, then there is little to no benefit to operators. The relationship here represents the pricing scheme that offers exactly no difference between Option 2: Modelled Insurance Requirement and Option 3: Fixed Limit for operators. Although some degree of non-linearity is expected, reflecting the fixed costs of underwriting and brokerage which occur at all levels of cover, it is assumed that the relationship modelled above (where there is no difference between options) is unrealistic.⁷⁰

⁷⁰ Commissioned evidence from GAD suggests that 25% of insurance premium is incurred as expenses. This figure was derived using published reports from the 7 largest providers of space insurance, calculating the proportion of total premium that is incurred as expenses. The reports cover all business within the category of marine, aviation and transport, rather than just space launch.

111. Additional sensitivity analysis, varying key MIR assumptions such as the maximum probable loss, will be included in the final stage IA.

2.3.3 Risks and Unintended Consequences

Potential risks of our **preferred approach** are considered below:

- HMG costs are higher than anticipated, for example as the modelling of safety risk and average values which underpinning the MIR approach, or information provided by operators is inaccurate. There is medium level of risk, given this is a new activity with no precedent in the UK. Sensitivity analysis has been undertaken to understand the effects of this uncertainty (Sensitivity Analysis). If an operator is guilty of non-compliance, wilful misconduct or gross negligence, the liabilities limits will be disapplied.
- Under MIR, operators will face some uncertainty over insurance costs when they are planning missions, which could affect UK launch demand (Direct costs to business: Compliance). The insurance amount will be confirmed by the regulator as a licence condition. The risks are considered low. Firstly, the guidance will provide sufficient detail to enable the operators to derive an indicative insurance amount and as a general assumption, it is estimated that insurance costs will be lower than under the Fixed Limit approach.
- The policy doesn't deliver intended effects, such as incentivising lower risk missions. Risks are considered low, as operators will also bear the costs of higher risk missions through higher insurance premiums. Also, it is estimated the insurance costs will be lower under MIR than the Fixed Limit approach.
- The risk of legal challenge by an operator specifically against the level of insurance requirements are likely to be low, as the insurance amount is based on the results of the safety case which is assessed part of the licence application. The regulator will apply specified values to these outputs as will be published in guidance.
- The risk of the regulations being difficult to enforce are likely to be low, as the SIA legislation establishes a clear regulatory framework, including enforcement powers for the regulator.

2.3.4 Wider Impacts

112. A full, detailed assessment of the wider impacts of the UK launch market has been conducted in 'SIA Secondary Legislation IA'. This covers the following tests:

- Small and Micro Business Assessment
- Innovation Test
- Equalities Test
- Justice Test
- Trade Impact
- Competition Assessment
- Environmental

113. The following tests were not required:

- Health Impact
- Rural Proofing
- Sustainable Development

114. Below, further detail is provided below for areas not sufficiently covered, such as the UK space insurance market.

2.3.5 Small and Micro Business Assessment

115. The proposal is expected to have the largest impact on space launch operations and space insurers as it will impose direct costs – upfront familiarisation costs and ongoing compliance costs (insurance costs). Other space-related activity (e.g. associated and ancillary services) may also be affected with some additional upfront familiarisation costs, although this is expected to be small.
116. However, it would not be appropriate to exclude SMBs from the regulations contained in this secondary legislation. This is because SMBs will likely benefit from this legislation, as it enables commercial spaceflight launch activities. Without the secondary legislation, it is unlikely that these SMBs would be able to enter the launch market (as unlimited insurance is not commercially available). If SMBs are excluded, the policy objectives will not be achieved.

Size of UK space sector businesses

117. A full assessment has been conducted in 'SIA Secondary Legislation IA'.⁷¹ Briefly, it can be summarised as:
- Based on London Economics' 'Size and Health of the UK Space Industry' (2018) report⁷², the average size of space sector organisations is estimated to be 29 employees - i.e. the average number of employees per organisation is small.
 - Within the space operations segment, several of the key beneficiaries of the regulation are likely to fall into the SMB category (e.g. all spaceports, some launch / orbital operators).
 - The same report finds that 13 organisations accounted for 83% of total space-related income, indicating that the sector is likely dominated by a few large businesses.
 - By region, the average number of employees by businesses ranges from 6 up to 57, indicating that most businesses will likely be categorised as either small or micro businesses.

Size of UK space insurance market

118. There are relatively few brokers and underwriters which have the experience and appetite for launch-related insurance. For many of them, such products are an extension of their aviation businesses or possibly transport or telecommunications groups.
119. Based on the 'Size and Health' report, the launch and satellite insurance (incl. brokerage) services market has grown considerably. Income is estimated at £88m in 2016/17 (increasing from £58m in 2014/15). However, it still accounts for a small proportion of the total space sector, representing less than 1% of total income and employment.

Mitigations

120. The regulations have been designed to reduce the impact on business whilst ensuring risks are mitigated. Whilst our preferred approach does impose additional upfront familiarisation costs through more complex guidance, it delivers net savings through lower insurance costs. Furthermore, the regulator will be responsible for determining insurance requirements, minimising operator engagement costs.

⁷¹ HM Government 'Space Industry Regulations 2020 Impact Assessment', July 2020 – available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904349/consultation-impact-assessment.pdf

⁷² London Economics 'Size and Health of the UK Space Industry 2018', 30 January 2019 – available at: <https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2018>

2.3.6 Competition Assessment

Space Insurance Market

121. An assessment of the space insurance market is provided in the 'Rationale for Intervention', in particular identifying a small level of supply due to high-barriers to entry (immaturity of the market, limited sector experience and no UK launch data) and low earnings potential. Based on this evidence, the market is more likely to be at risk of further contraction rather than growth.
122. The development of UK launch market could increase demand for services and improve UK launch-related data, increasing capacity of existing market participants and/or the number of new entrants. This will not enable the market to offer unlimited liability cover (and not negate the need for ongoing government intervention through liability limits).
123. Conversely, if a key player suffers large losses in space or another product area (whether related, such as aviation, or unrelated such as weather damage and disruption) or, more generally, experiences poor financial results, it could lead to reduced availability in the space sector. In a small pool of providers, the overall performance of an individual insurer is more important, as any change will be magnified by comparison with larger markets where the impact of one firm's capacity is diluted across a larger number of players. This could constraint market supply further to the extent that remaining providers can use its market power to increase prices.

2.3.7 Human Rights Impact

124. The preferred approach has no compliance issues with the Human Rights Act 1998.⁷³ This is because there is no limit to government compensation in excess of the liability limit, so potential claimants are not denied their full legal rights to seek compensation in the event of an accident.

3.0 Post Implementation Review

125. The Regulations will be subject to a formal review, five years from when the Regulations come into force. Also, the Government will review the MIR financial values annually to determine whether any further update is needed due to a significant circumstance within this period. For example, changes to the inflation rate, the Personal Injury Discount Rate applied in compensation cases, or an economic downturn having a significant impact on the statistics which are the basis for the derived values. The Government will consult on any proposed changes.
126. Furthermore, a post implementation review (PIR) plan will be published in the final stage IA following consultation, and the PIR will begin after the final package of secondary legislation has been implemented to monitor and evaluate its impact, and test the identified risks and unintended consequences of our preferred approach.

⁷³ HM Government, Human Rights Act 1998. Available at: <https://www.legislation.gov.uk/ukpga/1998/42/contents>

Annex 1: International Approaches to Liability Limits

127. This table summarises the various international approaches to liability limits. To aid comparison, financial values have been converted to pound sterling (using 24 January 2020 exchange rates, consistent with the 'SIA Secondary Legislation IA') and rounded to three significant figures.⁷⁴

Table 10 International approaches to liability limits

Country	Limit on Liability	Values in GBP
Australia	The limit on liability for an Australian launch permit holder is based on the Australian government's Maximum Probable Loss (MPL) methodology ⁷⁵ , up to AUD 100 million . The Australian government bears liability up to AUD 3 billion in relation to compensation to Australian nationals for damage of an amount in excess of the required insurance cover for the Australian launch permit. Liability in excess of AUD 3 billion falls to the operator. ⁷⁶	52.3 million, 1.58 billion
Austria, France	EUR 60 million limit on liability for damages on the surface of the Earth/aircraft. No limit on liability for damages in space.	50.6 million
Belgium	Limit on liability at the King's discretion (usually applied).	
Finland	EUR 60 million .	50.6 million
India	Limited to the liability level set out as a licence condition.	
Japan	For launch, limited to the amount of insurance required which, as of July 2019, is JPY 20 billion for all types of rockets. No cap for operations.	140 million
Luxembourg	Depends on the Concession. Agreement entered into between the operator and the government (limit on liability usually applied).	
Netherlands	Limited to the amount of insurance (approximately EUR 20 million for in-orbit liability).	16.9 million
Portugal	Amount discretionary to the members of government responsible for finance and science and technology.	
Russia	Limited to the amount of insurance cover required; however, the Russian government has a right of recourse against the property of licensee if the insured sum is insufficient.	
South Korea	Limited to KRW 200 billion .	131 million
UK (OSA)	EUR 60 million .	50.6 million
UK (SIA)	Government discretion.	
US	The cap is based on Maximum Probable Loss (MPL), up to USD 500 million . The US government bears liability up to USD 3.1 billion. Liability in excess of USD 3.1 billion falls to the launch operator.	383 million, 2.37 billion

⁷⁴ Based on 24th January 2020 exchange rates (consistent with the 'SIA Secondary Legislation IA'). Source: Bank of England, available at - <https://www.bankofengland.co.uk/boeapps/database/Rates.asp?TD=24&TM=Jan&TY=2020&into=GBP&rateview=D>

⁷⁵ Australian Government, 'Maximum Probable Loss Methodology', August 2019 - available at: <https://www.industry.gov.au/sites/default/files/2019-08/maximum-probable-loss-methodology-for-space-activities.pdf>

⁷⁶ Section 69(4) of the Australian Space (Launches and Returns) Act 2018, available at: <https://www.legislation.gov.au/Details/C2019C00246>

Annex 2: Modelled Insurance Requirements and Expected Cost to Government

128. The Modelled Insurance Requirement is based on the following estimated costs of injury and damage. The categories were chosen such that each could form part of a compensation claim under the UN Liability Convention, and correspond to those in the existing Nuclear Installations liability scheme. The financial values are based on the commissioned research by the Government Actuary's Department (GAD), which included information on the average level of payouts received in the UK.

129. Values in bold are those used in the analysis. According to UKSA Chief Engineer's Team analysis, the balance of risk between Operator and HMG is insensitive to these values. The values are subject to revision at least every five years.

Table 11 Financial values used in Modelled Insurance Requirement calculations

Type of Damage	Financial Value (£'000)	Additional Comments
<i>Death</i>		
Average award	£244	Ranging from £12,950 to over £4m, depending on type of damages awarded and whether the affected person has dependents. Awards however could be much higher than this..
Average-with-dependents award	£418	
<i>Injury</i>		
Minor	£5	Ranging from a few thousand to excess of £20m
Intermediate	£30	
Semi-serious	£192	
Lifetime care	£5,154	
<i>Property damage (per m²)</i>		
Commercial	£1.739	The business interruption rates were calculated based on Association of British Insurers data under licence to UKSA, GAD's own experience and average figures for stock held by British companies. This demonstrates that business interruption costs would account for around half of the difference between the value for domestic and commercial property rates and if a prudent approach is being used that the domestic property rate could be appropriately applied as the value with respect to property damage generally.
Without Business Interruption	£1.389	
Residential	£1.739	
Agricultural	£0.0019	
Without Business Interruption	£0.00184	
Environmental Damage	£250	

Annex 3: UK Space Industry Data

Table 12 UK Space Industry Data⁷⁷

Segment	Space activity	Nominal income 2017/18 (£m)	Nominal GVA 2017/18 (£m)	Number of companies* 2016/17
Space manufacturing	Fundamental applied research	£133	£74	144
	Ground segment systems and equipment	£304	£101	62
	Launch vehicles and subsystems	£975	£924	51
	Satellites/payloads/spacecraft and subsystems	£749	£344	103
	Scientific and engineering support	£122	£63	88
	Scientific instruments	£56	£32	44
	Suppliers of materials and components	£283	£111	157
Space operations	Third-party ground segment operation	£37	£5	9
	Ground station networks	£469	£118	23
	Launch brokerage services	£4	£2	9
	Spaceport operator**	£0	£0	7
	Range control service providers***	£0	£0	3
	Launch services	£2	£1	11
	Proprietary satellite operation (incl. sale/lease)	£1,813	£596	22
Space applications	Direct-To-Home (DTH) broadcasting	£7,223	£2,525	14
	Applications relying on embedded satellite signals/data	£357	£230	99
	Fixed satellite communication services (incl. VSAT)	£283	£102	76
	Location-based signal service providers	£121	£67	29
	Mobile satellite communication services	£584	£379	86
	Processors of satellite data (e.g. EO)	£191	£86	156
	Supply of user devices and equipment	£1,758	£461	148
Ancillary services	Business incubation and development	£46	£21	60
	Launch and satellite insurance services	£88	£37	20
	Legal and financial services	£12	£6	26
	Market research and consultancy services	£150	£72	150
	Policymaking, regulation and oversight	£32	£16	58
	Software and IT services	£145	£64	35
Total/result for the entire space industry		£15,938	£6,438	

* Note: 'Number of companies' refers to the number of companies engaged in the relevant space activity. Companies within the space industry may engage in multiple activities and also non-space-related activities. The total of this column therefore does not correspond to the total number of organisations in the space industry.

** The number of spaceports is taken from UK Space Agency⁷⁸

*** The number of range control service providers is taken from the Knowledge Transfer Network's 'Space Sector Landscape'⁷⁹

⁷⁷ London Economics 'The Size and Health of the UK Space Industry 2018', 30 January 2019 – available at: <https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2018>

⁷⁸ UK Space Agency 'How we are promoting and regulating spaceflight from the UK', 8 February 2019 – available at: <https://www.gov.uk/guidance/how-we-are-promoting-and-regulating-spaceflight-from-the-uk>

⁷⁹ Knowledge Transfer Network 'Space & Satellite Applications UK Landscape', accessed 15 November 2019– available at: <https://space.ktnlandscapes.com/>

Annex 4: Growth Effect Assumptions

Table 13 Space industry forecasts and assumptions for growth effects calculation

Segment	Space activity	GVA-to-turnover ratio 2017/18	Income CAGR 2015/16-17/18	Growth effects (Yes/No)
Space manufacturing	Fundamental applied research	0.56	9.00%	No
	Ground segment systems and equipment	0.33	6.85%	No
	Launch vehicles and subsystems	0.95	173.19%	No
	Satellites/payloads/spacecraft and subsystems	0.46	10.56%	No
	Scientific and engineering support	0.52	15.67%	No
	Scientific instruments	0.58	0.07%	No
	Suppliers of materials and components	0.39	9.06%	No
Space operations	Third-party ground segment operation	0.14	-11.24%	No
	Ground station networks	0.25	1.24%	No
	Launch brokerage services	0.48	2.23%	No
	Spaceport operators*	0	0	No
	Range control service providers*	0	0	No
	Launch services	0.33	98.20%	No
	Proprietary satellite operation (incl. sale/lease)	0.33	9.25%	Yes
Space applications	Direct-To-Home (DTH) broadcasting	0.35	0.59%	No
	Applications relying on embedded satellite signals/data	0.64	-0.72%	Yes
	Fixed satellite communication services (incl. VSAT)	0.36	1.00%	Yes
	Location-based signal service providers	0.55	2.07%	No
	Mobile satellite communication services	0.65	10.02%	Yes
	Processors of satellite data (e.g. EO)	0.45	10.57%	Yes
	Supply of user devices and equipment	0.26	9.80%	Yes
Ancillary services	Business incubation and development	0.45	4.49%	No
	Launch and satellite insurance services	0.43	5.30%	No
	Legal and financial services	0.53	-55.35%	No
	Market research and consultancy services	0.48	6.11%	No
	Policymaking, regulation and oversight	0.51	2.02%	No
	Software and IT services	0.44	7.67%	No

* There is no data for these space activities in the report

Annex 5: Familiarisation Cost Assumptions

Table 14 Space industry data and assumptions for familiarisation costs calculations

Segment	Space activity	Number of companies	Familiarisation (Yes/No)	Licence Type
Space manufacturing	Fundamental applied research	144	No	N/A
	Ground segment systems and equipment	62	No	N/A
	Launch vehicles and subsystems	51	No	N/A
	Satellites/payloads/spacecraft and subsystems	103	No	N/A
	Scientific and engineering support	88	No	N/A
	Scientific instruments	44	No	N/A
	Suppliers of materials and components	157	No	N/A
Space operations	Third-party ground segment operation	9	No	N/A
	Ground station networks	23	No	N/A
	Launch brokerage services	9	Yes	N/A
	Spaceport operators*	7	Yes	Spaceports
	Range control service providers*	4	Yes	Range
	Launch services	11	Yes	Launch
	Proprietary satellite operation (incl. sale/lease)	22	Yes	Orbital
Space applications	Direct-To-Home (DTH) broadcasting	14	No	N/A
	Applications relying on embedded satellite signals/data	99	No	N/A
	Fixed satellite communication services (incl. VSAT)	76	No	N/A
	Location-based signal service providers	29	No	N/A
	Mobile satellite communication services	86	No	N/A
	Processors of satellite data (e.g. EO)	156	No	N/A
	Supply of user devices and equipment	148	No	N/A
Ancillary services	Business incubation and development	60	No	N/A
	Launch and satellite insurance services	20	Yes	N/A
	Legal and financial services	26	Yes	N/A
	Market research and consultancy services	150	Yes	N/A
	Policymaking, regulation and oversight	58	Yes	N/A
	Software and IT services	35	No	N/A

* The number of spaceports is taken from the UK Space Agency⁸⁰

** The number of range control service providers is taken from the Knowledge Transfer Network's 'Space Sector Landscape'⁸¹ and UK Space Agency grant funding⁸²

Table 15: Familiarisation assumptions for prospective licence applicants

Prospective licence applicant prescribed and non-prescribed roles	Familiarisation (Yes/No)		
	Low	Central	High
Prescribed roles			
Accountable Manager	Yes	Yes	Yes
Security Manager*	Yes	Yes	Yes
Safety Manager**	Yes	Yes	Yes
Training Manager	Yes	Yes	Yes
Operations Manager	Yes	Yes	Yes
Launch Director**	Yes	Yes	Yes
Non-prescribed roles			
Engineering Manager	Yes	Yes	Yes
Senior Engineer	Yes	Yes	Yes
Legal Professional	Yes	Yes	Yes
Financial Professional	Yes	Yes	Yes
IT Manager	Yes	Yes	Yes
Business Support	Yes	Yes	Yes
Senior Manager	No	No	Yes
Manager	No	No	Yes

⁸⁰ UK Space Agency 'How we are promoting and regulating spaceflight from the UK', 8 February 2019 – available at: <https://www.gov.uk/guidance/how-we-are-promoting-and-regulating-spaceflight-from-the-uk>

⁸¹ Knowledge Transfer Network 'Space & Satellite Applications UK Landscape', accessed 15 November 2019– available at: <https://space.ktnlandscapes.com/>

⁸² UK Space Agency 'Four companies awarded grant funding to develop commercial range control services', 9 March 2019 – available at: <https://www.gov.uk/government/news/three-companies-awarded-grant-funding-to-develop-commercial-range-control-services>

Remote Pilot**	No	Yes	Yes
Flight Termination Officer**	No	Yes	Yes
Mission Management Controller**	No	Yes	Yes
Pilot in Command***	No	No	Yes
Flight Crew***	No	No	Yes

* Prescribed role for orbital operators only when there is a national security issue and, although not set out in the proposed regulations, there is an intention to require return operator licence applicants to appoint a security manager should activities give rise to issues of national security.

** Prescribed and non-prescribed roles only for Launch Operators and Launch Director needs to be a separate employee from the Safety Manager prescribed role

*** Launch Operators non-prescribed roles for spaceflight activities with human occupants

Table 16: Familiarisation assumptions for other interested stakeholders

Prospective licence applicant prescribed and non-prescribed roles	Familiarisation (Yes/No)		
	Low	Central	High
Legal Professional	Yes	Yes	Yes
Financial Professional	Yes	Yes	Yes
Business Support	Yes	Yes	Yes
Senior Manager	Yes	Yes	Yes
Manager	Yes	Yes	Yes

Table 17: Wage and non-wage costs for prospective licence applicants (£), 2020 prices

Wage and non-wage costs for prescribed and non-prescribed roles	Unit cost (£)		
	Low	Central	High
Prescribed roles			
Accountable Manager	£80,626	£95,958	£111,290
Security Manager*	£41,810	£53,467	£97,132
Safety Manager**	£41,810	£62,825	£97,132
Training Manager	£39,701	£50,030	£61,230
Operations Manager	£41,810	£62,825	£97,132
Launch Director**	£62,825	£90,399	£97,132
Non-prescribed roles			
Engineering Manager	£43,344	£66,105	£70,676
Senior Engineer	£40,016	£50,956	£65,447
Legal Professional	£40,016	£50,956	£65,447
Financial Professional	£40,016	£50,956	£65,447
IT Manager	£43,344	£55,440	£70,676
Business Support	£24,816	£30,388	£39,105
Senior Manager	£41,810	£62,825	£97,132
Manager	£38,941	£57,701	£90,399
Remote Pilot**	£108,015	£162,022	£216,030
Flight Termination Officer**	£80,626	£95,958	£116,136
Mission Management Controller**	£41,810	£78,316	£97,132
Pilot in Command***	£108,015	£162,022	£216,030
Flight Crew***	£81,011	£121,517	£162,022

* Prescribed role for orbital operators only when there is a national security issue and, although not set out in the proposed regulations, there is an intention to require return operator licence applicants to appoint a security manager should activities give rise to issues of national security.

** Prescribed and non-prescribed roles only for Launch Operators and Launch Director needs to be a separate employee from the Safety Manager prescribed role

*** Launch Operators non-prescribed roles for spaceflight activities with human occupants

Annex 6: UK Launch Market Forecasts

130. Market insights from UKSA have been used to forecast the number of licences, missions and launches in the UK launch market across a low, central and high scenario. Licence applications, launches and missions are not expected to take place until 2021, once the secondary legislation has been implemented, and are forecast over the appraisal period.

- **Low scenario** – This IA assumes the secondary legislation is implemented but no businesses decide to apply for a licence or enter the UK launch market in the low scenario. This gives us a lower bound.
- **Central scenario** – The forecasts in this scenario are UKSA’s best estimate about the number of licences, missions and launches in the UK, primarily driven by Satellite Launch Programme grant recipients, but also includes non-grant recipients known to be interested in entering the market.
- **High scenario** – This scenario shows the maximum plausible number of launches expected in the UK launch market, to present an upper bound.

131. The UK launch market launches forecasts (Table 18) have been broken down by the expected types of launch. These include horizontal launches to orbit, vertical launches to orbit, (vertical) sub-orbital launches and crewed sub-orbital launches.

Table 18: Number of launches, 2021-33

Type of launch	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Low													
Launch - Horizontal orbital	1	3	3	3	3	3	3	3	3	3	3	3	3
Launch - Vertical orbital	0	1	2	3	3	3	3	3	3	3	3	3	3
Launch - Vertical suborbital	-	1	1	1	1	1	1	1	1	1	1	1	1
Launch - Crewed	-	-	-	-	-	-	-	-	-	-	-	-	-
Central													
Launch - Horizontal orbital	1	3	3	3	3	3	3	3	3	3	3	3	3
Launch - Vertical orbital	1	3	4	5	5	5	5	5	5	5	5	5	5
Launch - Vertical suborbital	1	2	2	2	2	2	2	2	2	2	2	2	2
Launch - Crewed	0	0	0	0	0	0	0	0	0	0	0	0	0
High													
Launch - Horizontal orbital	1	3	4	6	10	11	14	14	16	16	16	16	16
Launch - Vertical orbital	2	6	13	20	24	32	34	36	36	36	36	36	36
Launch - Vertical suborbital	2	4	6	12	12	12	12	12	12	12	12	12	12
Launch - Crewed	0	0	0	0	0	0	0	5	10	20	20	20	20

132. The UK launch market orbital missions forecasts (Table 19) have been broken down by conventional, complex or novel, and constellation-class missions. Launches from abroad have been excluded, as these are covered by the OSA. Mission numbers have been estimated by the UKSA Orbit licensing team.

Table 19: Number of orbital missions**, 2021-33

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Low													
Conventional orbital mission	13	14	15	16	17	18	19	20	21	22	23	24	25
Complex or novel orbital mission	2	2	2	2	2	2	2	2	2	2	3	3	3
Constellation-class orbital mission	-	-	-	-	-	-	-	-	-	-	-	-	-
Central													
Conventional orbital mission	13	14	15	17	19	21	23	25	28	31	34	37	41
Complex or novel orbital mission	2	2	2	2	2	2	3	3	3	3	4	4	5
Constellation-class orbital mission	0	0	0	5	5	0	0	0	5	5	0	0	0
High													
Conventional orbital mission	13	15	17	20	23	26	30	35	40	46	53	61	70
Complex or novel orbital mission	2	2	2	2	3	3	3	4	4	5	6	7	8
Constellation-class orbital mission	5	0	0	10	10	0	0	0	10	10	0	0	0

** These are divided by the ratio of missions to satellite operators (4.73) to estimate the number of operators⁸³

⁸³ UK Space Agency 'UK registry: outer space objectives', 18 December 2019 – available at: <https://www.gov.uk/government/publications/uk-registry-outer-space-objects>

Annex 7: Impact Assessment Consultation Questions

We welcome comments and evidence regarding the costs, benefits and risks set out in this Impact Assessment. The consultation questions below set out specific areas of interest. At the very least, those responding to the consultation questions should read this Impact Assessment's [Summary Sheets](#).

Organisational details

- c. Who are you?
- a) a spaceport
 - b) a range control service provider
 - c) a launch operator
 - d) an orbital operator
 - e) a trade body
 - f) a union
 - g) a user of launch or satellite services (e.g. imagery)
 - h) an academic institution
 - i) an international body or group
 - j) an environmental group or organisation
 - k) an insurance, banking or finance company
 - l) a foreign government
 - m) an individual
 - n) another type of business or organisation (please provide details).
- d. Are you or your organisation considering applying for a licence under the Space Industry Act 2018?
- a) Yes
 - b) No
 - c) Not sure

Impact Assessment

19. In your view are there persons affected by the proposed secondary legislation that have not been captured in this Impact Assessment?
20. Who, in your view, has been omitted and how do you think they are affected (quantifying, if possible, the costs and/or benefits in £)?
21. Will you have to change any processes to comply with the proposed secondary legislation?
- Provide details of your changes (including estimated costs in £).
22. Are there any benefits associated with the proposed secondary legislation that are:
- misrepresented in this Impact Assessment?
 - not captured in this Impact Assessment?
- Provide details on which benefits (including estimated benefits in £).
23. Are there any costs associated with the proposed secondary legislation that are:
- misrepresented in this Impact Assessment?
 - not captured in this Impact Assessment?
- Provide details on which costs (including estimated costs in £).

24. Do you plan to familiarise yourself with the:

- proposed secondary legislation?
- accompanying guidance?

25. If you answered 'Yes' to question 24, provide details of the type and number of employees in your organisation that you expect will familiarise themselves with the proposed secondary legislation and accompanying guidance.

26. If you answered 'Yes' to question 24, estimate how long you expect this take (in working days) and an estimate of the cost in £, if possible.

27. What type and how many employees, if any, do you expect to engage with the regulator on behalf of you and/or your organisation during:

- a) The licensing process
- b) The regulator's monitoring regime

28. How many working days, if any, do you expect you and/or employees in your organisation to spend on:

- a) Engaging with the regulator during the licensing process
- b) Engaging with the regulator to monitor compliance

29. It is assumed that insurance premiums are 0.1% of the insurance cover provided, up to £50 million of insurance cover. In your opinion, is the figure of 0.1% realistic?

30. If not, do you expect premiums to be:

- higher?
- lower?

Provide further information to support your answer.