LAND'S END AIRPORT

CAP 1616 – AIRSPACE CHANGE PROPOSAL

FOR THE

LAND'S END TRANSIT CORRIDOR

-

STAGE 2 : DEVELOP & ASSESS

Stage 2A: Airspace Change Design Principle Evaluation & Options Assessment

ID : ACP-2019-75

LAND'S END AIRPORT

ACP SUBMISSION STEP 2A:
DESIGN PRINCIPLE EVALUATION & OPTIONS ASSESSMENT

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CONTENTS

i. Abbreviations & Glossary of Terms

ACAS	Airborne Collision Avoidance System	Equipment fitted to an aircraft that will provide information on other aircraft regarding range, altitude and bearing.
ACP	Airspace Change Proposal	The process by which a sponsor applies for a change to the design of a part of the UK airspace
ADS-B	Automatic Dependant Surveillance Broadcast	A way for an aircraft to determine its position via satellite navigation and periodically broadcast it, enabling it to be tracked
AIAA	Area of Intense Aerial Activity	
ATC	Air Traffic Control	
ATCA	Air Traffic Control Assistant	
ATCO	Air Traffic Control Officer	
ATCU	Air Traffic Control Unit	
ATM	Aerodrome Traffic Monitor	A type of radar used to assist in the safe operation of runways and airport utilisation
CAA	Civil Aviation Authority	The UK's aviation regulator ensuring that aviation reaches the highest safety standards
CAP	Civil Aviation Authority Publication	
CAT	Commercial Air Transport	
DP	Design Principle	
EC	Electronic Conspicuity	A means of aircraft transmitting their position to other ground or air-based systems
GA	General Aviation	
IFR	Instrument Flight Rules	A term used to describe a pilot flying and navigating the aircraft with reference to the instruments in the flight deck
ISSC	Isles of Scilly Steamship Company	
ISSG	Isles of Scilly Steamship Group	
LETC	Land's End Transit Corridor	

MLAT	Multilateration	A navigation and surveillance technique used to provide information on the position of an aircraft
PAX	Passengers	
PINS	Point In Space	A non-precision instrument approach mainly used by helicopters
RMZ	Radio Mandatory Zone	A designated piece of airspace that requires all aircraft to be fitted with and operate suitable two-way radio equipment
RNAS	Royal Naval Air Station	
RNAV	Area Navigation	A method of navigation that allows an aircraft to choose any course within a network of navigation beacons
SAR	Search and Rescue	
TCAS	Traffic Collision Avoidance System	Suitably equipped aircraft communicate digitally, between themselves, information regarding range, altitude and bearing to provide advice on airborne collision avoidance
TMZ	Transponder Mandatory Zone	A designated piece of airspace that requires all aircraft to be fitted with and operate electronic conspicuity equipment
UK	United Kingdom	

1 Introduction

1.1 This document forms part of the document set required in accordance with the requirements of the CAP1616 airspace change process.

1.2 This document aims to provide adequate evidence to satisfy Stage 2 Develop and Assess Gateway, Step 2A Design Principle Evaluation

1.3 This document should be read in conjunction with the Stage 2: Design Options document which gives descriptions of each option.

1.4 The following options to provide improved safety within the LETC are proposed for consideration

- Do nothing
- Obtain a radar feed from an existing radar unit
- Install a radar at or near Land's End Airport
- LETC reclassified as Class D controlled airspace
- LETC reclassified as Class E controlled airspace
- Establish a RMZ
- Establish a TMZ
- Establish a combined RMZ/TMZ
- Alter the size and dimensions of the LETC
- Utilise ADS-B technology

2 Options Assessment: Design Principle Evaluation

2.0.1

Tables 1-9 below summarise the impacts/benefits of the options evaluated. The tables are based on the pro-forma contained in CAP1616 Appendix E, page 200. The degree to which the design principle has been met is indicated by the following colour coding

Green	MET
Yellow	PARTIAL
Red	NOT MET (Or change represents a detriment)

2.1 Do Nothing

Design Principle Evaluation			
Do Nothing			**REJECT**
This option leaves the current LETC as it is, and no measures are taken to address safety concerns			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	No Change	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	Doing nothing doesn't maintain the highest standards of safety as other options are better suited.	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	Because of concerns highlighted by airspace users, safe access could be enhanced	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the	Doing nothing does not explore any technical options at all	

	Airport's and commercial operator's income, the equipment costs for GA and other users.		
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations, and should explore measures, including classification and flexible use of airspace, where possible and appropriate, to improve access and decrease airspace segregation.	Doing nothing does not explore any airspace options at all	
DP6	Options should consider an RMZ and / or TMZ solution.	Doing nothing does not explore any airspace options at all	
DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change	
DP8	As feedback was received regarding the size of the airspace (some requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	Doing nothing does not explore any changes to size of the LETC	
DP9	The airspace design shall consider operation by a single authority	Doing nothing does not explore any Air Traffic Service options at all	
Table 1: Design Principle Evaluation – Do Nothing			

2.1.1 Do Nothing conclusion

There have been safety concerns raised from airspace users and so making no improvements to the LETC will not reduce the amount of unknown aircraft flying within it. Six of the design principles were not met and so the 'Do Nothing' option was rejected.

2.2 Obtain radar feed from an existing radar unit

Design Principle Evaluation			
Obtain radar feed from an existing radar unit			**REJECT**
Radar information fed from an existing Radar unit into ATM equipment at Land's End airport. See Stage 2: Design Options document for more detail			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	Having radar information would enhance the airspace and options available to ATC	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	See above	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	This option would continue to offer full access for all users and enhance safety	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the Airport's and commercial operator's income, the equipment costs for GA and other users.	Obtaining radar information and installing the relevant traffic monitoring equipment at Land's End would add a reoccurring financial burden upon the airport. All ATCO's would need a measure of retraining that would add a one-off cost. During this time of increased financial pressure upon the company and reduced income due to COVID and the uncertainty regarding the future this expenditure is neither justified nor available	
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations, and should explore measures, including classification and flexible use of airspace, where possible and appropriate, to improve access and decrease airspace segregation.	No change to the type of airspace within the LETC	

DP6	Options should consider an RMZ and / or TMZ solution.	No change to the type of airspace within the LETC. Should this option be chosen then there might not be a need for RMZ/TMZ	
DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change to the type of airspace within the LETC	
DP8	As feedback was received regarding the size of the airspace (some requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	While there is no requirement to change the existing size of the LETC airspace for this option, doing so may further increase the safety benefits to all users.	
DP9	The airspace design shall consider operation by a single authority	Should this option be chosen then there might be a need for establishing operation of the LETC by a single authority	
Table 2: Design Principle Evaluation – Obtain Radar Feed			

2.2.1 Obtain Radar Feed conclusion

Whilst this option does seem to meet five of the design principles the impact of not meeting the others is not inconsiderable. The initial cost outlay in contracts with ATE and a radar unit (circa £180K initially then £60K annually), equipment purchase costs (circa £45K) and then training of ATC staff (circa £150K) would place the company in financial hardship. Add to this the fact that the costs related to obtaining a feed are non-controllable at the end of the initial contract, financially this is not viable. No exact figures have been obtained but cost saving measures are already in place throughout the Isles of Scilly Steamship Group, so it is not prudent to continue exploring this option. For these reasons this option has been rejected.

*(Estimated figures obtained from current ATE contractor)

2.3 Install a radar at or near Land's End airport

Design Principle Evaluation			
Install a radar at or near Land's End airport			REJECT
Installation of a radar unit and suitable equipment installed at Land's End to provide the appropriate levels of ATS from. See Stage 2: Design Options document for more detail.			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	Having radar information would enhance the airspace and options available to ATC	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	See above	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	This option would continue to offer full access for all users and enhance safety	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the Airport's and commercial operator's income, the equipment costs for GA and other users.	If the radar was to be installed away from the airport, land would need to be purchased, planning permissions obtained and a reliable means of feeding the radar information to the airport sought. Compatible radar displays would need to purchased, all ATCO's need to be retrained at an approved ATS college and ATE contracts entered into to service and maintain the equipment. All of this would place an unwarranted financial burden on the company as a whole and would be unsustainable.	
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations, and should explore measures, including classification and flexible use of airspace, where possible and	No change to the type of airspace within the LETC	

	appropriate, to improve access and decrease airspace segregation.		
DP6	Options should consider an RMZ and / or TMZ solution.	No change to the type of airspace within the LETC. Should this option be chosen then there might not be a need for RMZ/TMZ	
DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change to the type of airspace within the LETC	
DP8	As feedback was received regarding the size of the airspace (some requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	While there is no requirement to change the existing size of the LETC airspace for this option, doing so may further increase the safety benefits to all users.	
DP9	The airspace design shall consider operation by a single authority	Should this option be chosen then there might be a need for establishing operation of the LETC by a single authority	
Table 3: Design Principle Evaluation – Install a radar on or near Land's End airport			

2.3.1 Install Radar conclusion

Similar to the issues raised in the previous option the negative financial impact on the company would be considerable. It is estimated that approximately £2M - £6M (depending on whether primary or primary & secondary) would be needed to be purchase and install a radar unit at the airport. For this reason alone, this option has been rejected.

*(Estimated figures obtained from current ATE contractor)

2.4 LETC reclassified as Class D Controlled Airspace

Design Principle Evaluation			
LETC reclassified as Class D Controlled Airspace			**REJECT**
Change the LETC from Class G uncontrolled to Class D controlled airspace. See Stage 2: Design Options document for more detail.			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	Having class D controlled airspace would eliminate the unknown traffic element as all flights would need ATC clearance to operate within the LETC	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	Safety would be increased for the above reasons; however, Class D may mean that certain flights wouldn't continue to operate within the LETC as freely as before due to the need for ATC clearance.	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	Entry into Class D airspace requires ATC clearance so some users may not have access due to being non-radio or unable to comply with ATC instructions	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the Airport's and commercial operator's income, the equipment costs for GA and other users.	Class D doesn't explore any technical options available. ATC clearance is needed to enter and operate within class D so any aircraft not radio equipped would need to purchase and install such.	
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations, and should explore measures, including classification and flexible use of airspace, where possible and appropriate, to improve access and decrease airspace segregation.	ATC clearance and adherence to ATC instructions within class D is needed for all flights so safety would be increased as the unknown traffic should no longer be a factor. However, access may be restricted to those not wishing to receive an ATS.	
DP6	Options should consider an RMZ and / or TMZ solution.	Class D doesn't mandate an RMZ or TMZ. However, all	

		flights need to be in 2-way radio communication with ATC therefore covering the RMZ requirements anyway	
DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change	
DP8	As feedback was received regarding the size of the airspace (some requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	While there is no requirement to change the existing size of the LETC airspace for this option, doing so may further increase the safety benefits to all users.	
DP9	The airspace design shall consider operation by a single authority	Should this option be chosen then there might be a need for establishing operation of the LETC by a single authority	
Table 4: Design Principle Evaluation – Reclassify LETC as Class D controlled Airspace			

2.4.1 Class D Airspace conclusion

Changing to class D controlled airspace would more than likely necessitate the need to upgrade to service provided by the air traffic control unit at Land's End. Two of the ATCO's would need to obtain further ATS qualifications from an approved college and the other three would need refresher training at the same college. It is estimated that the one-off costs involved would be in the region of £80K. At present the college is not taking on any students due to ongoing COVID-19 restrictions so a start date cannot be estimated. Reclassification to class D controlled airspace may also hinder military flight needs as they operate extensively to the south west of the coastline and sometimes are unable to communicate their exact tracks and intentions. For these reasons 'Class D' airspace was rejected as an option.

2.5 LETC reclassified as Class E Controlled Airspace

Design Principle Evaluation			
LETC reclassified as Class E Controlled Airspace			**REJECT**
Change the LETC from Class G uncontrolled to Class E controlled airspace. See Stage 2: Design Options document for more detail.			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	Having class E controlled airspace would not eliminate the unknown traffic element as only IFR flights need to have a clearance and comply with ATC instructions. Aircraft operating VFR, should they wish, do not need to participate in any ATS provided. If and when Class E airspace is refined by the CAA, having the TMZ requirement would only partially enhance safety for some users as not all users will have access to an ACAS system and there would still possibly be aircraft not in radio communication.	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	Upgrading the LETC to class E would be in line with CAP1711 future plans for airspace. The value of Class E for the LETC is discussed above, however safety would be enhanced for some users.	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	Only IFR flights would need ATC clearance to enter the airspace and since all these flights are already known traffic there would be no enhancement to safety within the LETC	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the Airport's and commercial operator's income, the	Class E as it stands today doesn't explore any technical options available. A future redefined class E airspace would see the use of electronic conspicuity for participating flights.	

	equipment costs for GA and other users.		
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations, and should explore measures, including classification and flexible use of airspace, where possible and appropriate, to improve access and decrease airspace segregation.	Only IFR flights would need ATC clearance to enter the airspace and since all these flights are already known traffic there would be no enhancement to safety within the LETC. Access would remain the same for VFR as no clearance or contact with ATC is needed.	
DP6	Options should consider an RMZ and / or TMZ solution.	Class E as it stands today doesn't mandate an RMZ or TMZ, however a future redefined class E utilises a TMZ	
DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change	
DP8	As feedback was received regarding the size of the airspace (some requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	While there is no requirement to change the existing size of the LETC airspace for this option, doing so may further increase the safety benefits to all users.	
DP9	The airspace design shall consider operation by a single authority	Should this option be chosen then there might be a need for establishing operation of the LETC by a single authority	

Table 5: Design Principle Evaluation – Reclassify LETC as Class E controlled Airspace

2.5.1 Class E Airspace conclusion

Changing to class E controlled airspace wouldn't offer any significant safety enhancements to the LETC airspace users because there could still be an unknown VFR traffic element operating within the LETC therefore this option has been rejected.

2.6 LETC reclassified as an RMZ

Design Principle Evaluation			
LETC reclassified as a Radio Mandatory Zone (RMZ)			**ACCEPT**
Change the LETC from Class G uncontrolled to an RMZ. See Stage 2: Design Options document for more detail.			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	Establishing the LETC as an RMZ would eliminate the unknown traffic element as all aircraft would need to be in 2-way communication with ATC therefore, safety would be enhanced for all users	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	By ensuring 2-way radio communication with ATC there is a significant safety enhancement thus potentially lowering the possibility of airprox and mid-air collisions	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	An RMZ would enhance safety for all airspace users and since the cost of satisfactory 2-way radio equipment isn't prohibitive to most user's access to the airspace is still possible.	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the Airport's and commercial operator's income, the equipment costs for GA and other users.	An RMZ doesn't explore any current technical solutions. Installing satisfactory 2-way radio communication equipment is affordable for most GA airspace users and is not considered to be an unacceptable cost.	
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations, and should explore measures, including classification and flexible use of airspace, where possible and appropriate, to improve access and decrease airspace segregation.	Whilst not classified as controlled airspace an RMZ adds a measure of certainty to the traffic operating within the LETC allowing for safer and more efficient access and operation of aircraft	

DP6	Options should consider an RMZ and / or TMZ solution.		
DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change	
DP8	As feedback was received regarding the size of the airspace (some requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	While there is no requirement to change the existing size of the LETC airspace for this option, doing so may further increase the safety benefits to all users.	
DP9	The airspace design shall consider operation by a single authority	Establishing an RMZ would encourage all ATCUs operating within the LETC to consider a single authority	
Table 6: Design Principle Evaluation – Reclassify LETC as an RMZ			

2.6.1 Establish RMZ conclusion

Establishing the LETC as an RMZ would greatly enhance safety for all aircraft operating within its boundaries and whilst some GA aircraft may have to upgrade or even install and use suitable 2-way radio equipment the expense can be considered justified as the positive safety impact on all airspace users would be significant. 'Establish an RMZ' will be taken forward as an option.

2.7 LETC reclassified as a TMZ

Design Principle Evaluation			
LETC reclassified as a Transponder Mandatory Zone (TMZ)			**REJECT**
Change the LETC from Class G uncontrolled to a TMZ. See Stage 2: Design Options document for more detail.			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	Establishing the LETC as an TMZ would eliminate the unknown traffic element as all aircraft would need to be equipped with and operate suitable transponder equipment	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	By ensuring electronic conspicuity there would be a safety enhancement for all aircraft equipped with some form of ACAS, thus potentially lowering the possibility of airprox and mid-air collisions. This would not enhance safety for aircraft without ACAS.	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	Purchasing transponder equipment isn't prohibitive to most user's so access to the airspace is still possible. There may be a very small number of aircraft that won't/can't fit a transponder and so would be excluded from the LETC, however, the percentage is likely to be negligible so the impact of this would also be negligible.	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the Airport's and commercial operator's income, the equipment costs for GA and other users.	A TMZ explores technical solutions as it involves current EC technology. Installing satisfactory transponder equipment is affordable for most GA airspace users and is not considered to be an unacceptable cost.	
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations,	Whilst not classified as controlled airspace a TMZ adds a measure of certainty to the	

	and should explore measures, including classification and flexible use of airspace, where possible and appropriate, to improve access and decrease airspace segregation.	traffic operating within the LETC allowing for safer and more efficient access and operation of aircraft	
DP6	Options should consider an RMZ and / or TMZ solution.		
DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change	
DP8	As feedback was received regarding the size of the airspace (some requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	While there is no requirement to change the existing size of the LETC airspace for this option, doing so may further increase the safety benefits to all users.	
DP9	The airspace design shall consider operation by a single authority	Should this option be chosen then there might be a need for establishing operation of the LETC by a single authority	
Table 7: Design Principle Evaluation – Reclassify LETC as a TMZ			

2.7.1 Establish TMZ conclusion

Establishing the LETC as a TMZ would enhance safety for aircraft equipped with a system of ACAS but would offer no real enhancement to other aircraft. Land's End ATC currently doesn't have any way to utilise transponder information and so would have to coordinate with other ATCU's to verify or identify aircraft within the LETC. This would increase controller workload and may introduce delays into handling aircraft movements and lower the level of service provided. In order to utilise transponder information a radar feed and ATM would need to be installed at Land's End with the costs and thoughts behind this already laid out in para 2.2 'Obtain Radar Feed'. Because of only a partial safety enhancement for some aircraft and the reasons laid out in para 2.2 'Establish a TMZ' will not be taken forward as an option.

2.8 LETC reclassified as a Combined RMZ/TMZ

Design Principle Evaluation			
LETC reclassified as a combined RMZ/TMZ			**ACCEPT**
Change the LETC from Class G uncontrolled to a combined RMZ/TMZ. See Stage 2: Design Options document for more detail.			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	A combined RMZ/TMZ would eliminate the unknown traffic element as all aircraft would need to be equipped with and operate suitable transponder and radio equipment	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	By ensuring electronic conspicuity there would be a safety enhancement for all aircraft equipped with some form of ACAS, and by ensuring radio contact the unknown traffic element would be removed. Both these would help to lower the possibility of airprox and mid-air collisions. This would enhance safety for all airspace users.	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	Purchasing transponder equipment isn't prohibitive to most users and most aircraft are already equipped with satisfactory 2-way radio equipment so access to the airspace is still possible.	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the Airport's and commercial operator's income, the equipment costs for GA and other users.	The TMZ part explores technical solutions as it involves current EC technology. Installing satisfactory transponder equipment is affordable for most GA airspace users and is not considered to be an unacceptable cost.	
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations, and should explore measures, including classification and flexible	Whilst not classified as controlled airspace an RMZ/TMZ adds a measure of certainty to the traffic operating within the LETC allowing for	

	use of airspace, where possible and appropriate, to improve access and decrease airspace segregation.	safer and more efficient access and operation of aircraft	
DP6	Options should consider an RMZ and / or TMZ solution.		
DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change	
DP8	As feedback was received regarding the size of the airspace (some requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	While there is no requirement to change the existing size of the LETC airspace for this option, doing so may further increase the safety benefits to all users.	
DP9	The airspace design shall consider operation by a single authority	Establishing an RMZ/TMZ would open discussions with the relevant authorities operating within the LETC as to whether a single authority was necessary	

Table 8: Design Principle Evaluation – Reclassify LETC as a combined RMZ/TMZ

2.8.1 Establish Combined RMZ/TMZ conclusion

Establishing an RMZ/TMZ would enhance safety for all users of the LETC. Land's End ATC currently doesn't have any way to utilise transponder information and so would have to coordinate with other ATCU's to verify or identify aircraft within the LETC. This would increase controller workload and may introduce delays into handling aircraft movements and lower the level of service provided so ways would have to be explored to mitigate this. Because of the RMZ element Land's End ATC could verify verbally compliance with the TMZ portion within the parameters of any letters of agreement with other ATCUs. There is enough scope to explore this option further so 'Establish a Combined RMZ/TMZ' will be taken forward as an option.

2.9 Alter the size and dimensions of the LETC

Design Principle Evaluation			
Alter the size and dimensions of the LETC			**ACCEPT**
Explore whether changing the size of the LETC would enhance safety. See Stage 2: Design Options document for more detail.			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	This option would increase awareness of the presence of IAP at Land's End	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	This option wouldn't modernise the airspace or reclassify it to provide a safety enhancement in that regard. However, it would increase awareness of the presence of IAP at Land's End	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	Access to the airspace would not change for any user	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the Airport's and commercial operator's income, the equipment costs for GA and other users.	This option wouldn't utilise any technological solution and would pose no financial hardship to any LETC airspace user.	
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations, and should explore measures, including classification and flexible use of airspace, where possible and appropriate, to improve access and decrease airspace segregation.	This option would not alter the classification of airspace but would enhance awareness of IAP at Land's End Airport.	
DP6	Options should consider an RMZ and / or TMZ solution.	No change to the type of airspace within the LETC. Should this option be chosen then there might be a need for RMZ/TMZ to be considered	

DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change to the impact made on the environment	
DP8	As feedback was received regarding the size of the airspace (some requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	Exploring the possibility of increasing the size of the LETC around the IAP for RWY's 16 & 34 would be of positive effect and not restrict access for users. Other changes to the dimensions should be considered and their impact assessed as well.	
DP9	The airspace design shall consider operation by a single authority	Should this option be chosen then there might not be a need for establishing operation of the LETC by a single authority	

Table 9: Design Principle Evaluation – Alter the size and dimensions of the LETC

2.9.1 Alter the size and dimensions of the LETC conclusion

Changing the dimensions of the LETC might have negligible effect on overall safety if it was done in isolation. If combined with another option from the choices above it could only serve to enhance safety for all users. Changing the dimensions to fully include the IAP at Land's End should be considered a priority. "Alter the size and dimensions of the LETC" will be taken forward as an option.

3.0 Utilise ADS-B technology

Design Principle Evaluation			
Utilise ADS-B technology			REJECT
Explore ways to utilise ADS-B technology. See Stage 2: Design Options document for more detail.			
Design Principle		**Summary of Assessment**	**MET?**
DP1	The airspace design and its operation must be as safe or safer than today for all airspace users that are affected by the airspace change.	No changes to current LETC	
DP2	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	The CAA sees the use and interoperability of ADS-B as key to airspace modernisation outside of controlled airspace. CAP1711, chap 4, 4.34 (p73)	
DP3	Ensure that all airspace users, current & future, retain the ability to have safe and efficient access to the airspace.	No changes to current LETC	
DP4	Ensure that all possible technical solutions – both existing and emerging – are considered (e.g. RADAR, ADSB, MLAT, TCAS). The lifecycle cost of options shall be affordable to the Airport's and commercial operator's income, the equipment costs for GA and other users.	Exploring ADS-B technology would meet this DP	
DP5	Controlled airspace options should ensure there is safe and efficient access for other types of operations, and should explore measures, including classification and flexible use of airspace, where possible and appropriate, to improve access and decrease airspace segregation.	No change to the LETC	
DP6	Options should consider an RMZ and / or TMZ solution.		
DP7	Ensure that any changes fully consider any environmental impact – to include noise, air pollution and social issues.	No change to LETC	
DP8	As feedback was received regarding the size of the airspace (some	No change to the dimensions of airspace within the LETC.	

	requesting a small volume and others a larger volume), both the height and breadth of the LETC will be fully considered.	Should this option be chosen then there may be a need for changing the size of the LETC to encompass the IAP	
DP9	The airspace design shall consider operation by a single authority	This option wouldn't need a single authority to take over operation	
Table 10: Design Principle Evaluation – Explore ADS-B technology			

3.0.1 ADS-B conclusion

Installing an ADS-B receiver at the airport would be inexpensive and carried out relatively simply. It would enhance the information provided electronically between aircraft but not provide ATC with anything that could be utilised by them. The technology is currently only on trial in the UK for ATC applications and so any information available to ATC can only be used for forward planning purposes and not to provide an air traffic control service. There would be no changes to the LETC dimensions or airspace and thus an unknown traffic element would still exist. 'ADS-B' will not be taken forward as an option.

3 Safety Assessment

3.0.1 Primary Hazards within the LETC

A safety analysis has been undertaken of flying activities within the LETC and the primary list of hazards is as follows

- Non-radio aircraft
- Radio equipped aircraft not communicating effectively
- Aircraft not visible electronically to other ACAS equipped aircraft

3.1 Do Nothing

By doing nothing safety is not improved and potential for aircraft to conflict with one another is either the same or increased due to the larger number of aircraft now flying within the LETC. Unknown traffic flying within the LETC is still a high possibility.

3.2 Obtain Radar Feed & Install A Radar at Land's End

This option would provide ATC with far more information regarding traffic in the LETC and potentially allow for greater traffic information to be passed in a timely manner to participating aircraft. There may still be traffic that were non radio and therefore unknown to ATC, but their progress may be able to be monitored on the radar feed. Depending upon the level of service being provided positioning, sequencing or deconflicting advice/instructions may be given to pilots to help achieve traffic avoidance, therefore safety would be improved.

3.3 Reclassify the LETC to Class D Controlled Airspace

This option would remove the unknown traffic element from the LETC as all aircraft would require clearance to enter and have to follow ATC instructions whilst operating within the LETC. Robust letters of agreement would need to be entered into between all operating agencies within the LETC (St Mary's Airport, Land's End Airport, Penzance Heliport, Tresco Heliport) and also regular heavy users of the airspace (RNAS Culdrose, Skybus, Cobham Flight Academy, PDG Helicopters), in order to ensure the raising of safety standards. Aircraft not visible electronically to other ACAS equipped aircraft would still be present within the LETC.

3.4 Reclassify the LETC to Class E Controlled Airspace

This option would not remove the unknown traffic element from the LETC as not all aircraft would require clearance to enter and have to follow ATC instructions whilst operating within the LETC. IFR aircraft within the LETC would need be in radio contact with ATC but since there is no evidence to suggest that IFR aircraft at present don't contact ATC before entering the LETC, safety would not be increased for those participating. Aircraft not visible electronically to other ACAS equipped aircraft would still be present within the LETC.

3.5 Establish the LETC as an RMZ

This option would ensure that all aircraft operating within the LETC would be in contact with ATC thus removing the unknown traffic element, thus improving safety. There would exist the possibility of aircraft operating on different ATC frequencies so robust letters of agreement between relevant ATC units would need to be in place. The possibility of one operating authority would need to be investigated. Aircraft not visible electronically to other ACAS equipped aircraft wold still be present within the LETC.

3.6 Establish the LETC as a TMZ

This option would ensure that all aircraft operating within the LETC would be operating a transponder so would be visible to radar equipped ATC units. There wouldn't necessarily be a requirement to be in two-way radio contact with ATC so to any non-radar equipped ATC units there would still be an unknown traffic element. There would exist the possibility of aircraft operating on different ATC frequencies so robust letters of agreement between relevant ATC units would need to be in place. Co-ordination between ATCU's, to verify traffic position and compliance would increase, and would increase the workload of ATS staff. All aircraft would be visible electronically to other ACAS equipped aircraft so this would potentially increase safety for those aircraft.

3.7 Establish the LETC as a Combined RMZ/TMZ

This option would ensure that all aircraft operating within the LETC would be operating a transponder and two-way radio so would be visible to radar equipped ATC units, other ACAS equipped aircraft and be in two-way radio contact with ATC. This would eliminate the unknown traffic element from the LETC and greatly improve safety for all users. There would exist the possibility of aircraft operating on different ATC frequencies so robust letters of agreement between relevant ATC units would need to be in place. Co-ordination between ATCU's might increase but because all aircraft would be in radio contact with an ATC unit there may be a way to verify transponder codes without the need for detailed coordination thus ensuring that ATS staff don't get overloaded. The possibility of one operating authority would need to be investigated.

3.8 Alter the size and dimensions of the LETC

This option would enhance the awareness of IAP at Land's End. There would still be the possibility of unknown traffic but having greater awareness may encourage all aircraft, operating in the vicinity of the LETC, to be in 2-way contact with ATC during airport operating hours. Exploring the possibility of other changes in the dimensions of the LETC may lead to other possibilities and opportunities to enhance safety.

3.9 Utilise ADS-B technology

This option would encourage all aircraft operating within the LETC to operate electronic conspicuity so should make them visible to radar equipped ATC units. There wouldn't necessarily be a requirement to be in two-way radio contact with ATC so to any non-radar equipped ATC units there would still be an unknown traffic element. All aircraft would be visible electronically to other ACAS equipped aircraft but currently the amount of information available is not at the level of a transponder equipped aircraft. Non radar equipped ATC units would not be able to utilise this information as any information displayed in the ATCU would be from an unapproved source and not be able to be used in a flight safety manner.

4 High Level Qualitative Cost Assessment

4.1 Do Nothing

Doing nothing doesn't carry any quantitative cost at all as no changes would be made to any of the airspace or ATS systems. The environmental impact both on air quality and noise would remain the same as they are now and access to the airspace would not change.

4.2 Obtain Radar Feed or Install A Radar at Land's End

The environmental impact of purchasing land and installing a radar would be significant in the location that we are in. The impact of having an airport in this rural location is high enough and potentially having to purchase land and install a radar nearby as well would be detrimental. The visual and noise impacts to flora and fauna would be negative and potentially have lasting effects.

These two options have some similarities in costs mainly in the area of training for ATS staff. Having a radar information available for ATS staff to provide a safety critical service from an approved source would necessitate a higher level of training at an approved college at a cost of circa £150K and would need a time period of around 12-18 months for all staff to be fully licenced. The purchase of a radar would be circa £2-6M and along with contracts for supplying the information and maintaining the equipment (£60-180K if no radar installed) the financial implications of any sort of radar equipment or radar feed information places these options out of reach and prohibitive to Land's End Airport.

4.3 Reclassify the LETC to Class D or E Controlled Airspace

This option on the surface doesn't seem to have any huge cost implications to the airport, however, the level of ATS provided would have to be enhanced therefore there would be a training cost for ATS staff of circa £100K. Again, the time needed to complete training for all staff would stretch to around 12-18 months as only one ATCO could be away at a time at the college. Environmental and societal impacts would stay the same as this option wouldn't call for any change in the routing of aircraft or mean an increase in traffic levels. During this time of reduced income and uncertain future finances this cost is not one that the airport can budget for and so the cost is prohibitive to the company.

4.4 Establish the LETC as an RMZ or TMZ or as a Combined RMZ/TMZ

These options have been grouped together for this analysis as they have very similar implications in cost, impact on the wider society and impact on airspace users.

The establishment of any of these options would not create any further environmental impact in terms of noise or air/noise pollution as the routing of aircraft would not change. The cost to the airport itself for any RMZ option would be nil as it already operates a full air traffic control service and so has approved VHF radio equipment already installed. The TMZ option to the airport would only have a cost attached if radar equipment were to be installed and has been detailed above in para 4.2.

An RMZ option would have a cost to any aircraft that wasn't already fitted with suitable 2-way radio equipment (from around £500 to £3000), but this is estimated to be of a very low percentage (less than 1%) of airspace users and so the impact would be negligible. The impact is similar for those aircraft not fitted or not going to be fitted with transponder equipment.

4.5 Alter the size and dimensions of the LETC

This option wouldn't carry any monetary costs to either the airport or airspace users as no extra equipment needs to be installed.

4.6 Utilise ADS-B technology

Utilising ADS-B technology would not create any further environmental impact in terms of noise or air/noise pollution as the routing of aircraft would not change. The cost to the airport itself for this option would be negligible as antennae and receiving equipment is currently circa <£1K. As any information received would not be from a CAA approved source, and could only be used for forward planning purposes, no specialised equipment would need to be purchased by the airport.

Access would remain the same for all users as the type and classification of airspace would remain the same.

5 Conclusion and Shortlist

5.1 Options of "Obtain of radar feed from an existing radar unit" and "Install a radar at or near Land's End airport" both meet 6 of the DPs, however, because of the disproportional expense and ongoing costs they have both been rejected and will not be carried forward.

5.2 The "LETC reclassified as Class D Controlled Airspace" option also involves a high cost that cannot be carried by the airport and a potential of severe disruption to military training aircraft and even though this option met 4 of the DPs, it won't be carried forward.

5.3 Even though meeting 3 of the DPs the "LETC reclassified as Class E Controlled Airspace" option wouldn't offer any significant safety enhancements to the LETC airspace users because there could still be an unknown VFR traffic element operating within the LETC therefore this option has been rejected and won't be carried forward.

5.4 Establishing the LETC as an RMZ met 5 of the DPs and would greatly enhance safety for all aircraft operating within its boundaries and whilst some GA aircraft may have to upgrade or even install and use suitable 2-way radio equipment the expense can be considered justified as the positive safety impact on all airspace users would be significant, therefore, this option will be carried forward.

5.5 Establishing the LETC as a TMZ would enhance safety for aircraft equipped with a system of ACAS but would offer no real enhancement to other aircraft. Land's End ATC currently doesn't have any way to utilise transponder information and so would have to coordinate with other ATCU's to verify or identify aircraft within the LETC, thus increasing controller workload and may introduce delays into handling aircraft movements and lower the level of service provided. In order to utilise transponder information a radar feed and ATM would need to be installed at Land's End with the costs and thoughts behind this already laid out in para 2.2 'Obtain Radar Feed'. Because of only a partial safety enhancement for some aircraft and the reasons laid out in para 2.2 'Establish a TMZ' will not be taken forward.

5.6 Establishing an RMZ/TMZ met 8 out of the 9 DPs and would enhance safety for all users of the LETC. Land's End ATC currently doesn't have any way to utilise transponder information and so would have to coordinate with other ATCU's to verify or identify aircraft within the LETC. As detailed above radar feed would not be an option available to ATS Land's End but because of the RMZ element Land's End ATC could verify verbally compliance with the TMZ portion within the parameters of any letters of agreement with other ATCUs. There is enough scope to explore this option further so 'Establish a Combined RMZ/TMZ' will be taken forward.

5.7 Altering the dimensions of the LETC might have negligible effect on overall safety if it was done in isolation but combined with another option from the choices above it could only serve to enhance safety for all users. Changing the dimensions to fully include the IAP at Land's End should be considered a priority. "Alter the size and dimensions of the LETC" in combination with another option will be taken forward.

5.8 Installing an ADS-B receiver at the airport would not provide ATS staff with any workable information that would enhance the safety critical service they provide to users of the LETC. While it did meet 5 of the DPs this option will not be taken forward, however it may be possible to utilise this technology in the future.

5.9 The options carried forward and shortlisted are as follows

- Establish the LETC as an RMZ
- Establish the LETC as a combined RMZ/TMZ
- Alter the dimensions of the LETC (Combined with one of the above options)