CAP1616 STEP 2B – INITIAL OPTIONS APPRAISAL

VERSION 1.0

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HELIOS

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INTRODUCTION

- Bournemouth Airport has initiated a CAA CAP1616 Airspace Change Process (ACP) in 2018.
- The Bournemouth Airspace Change Proposal successfully passed the ACP Stage 1 Define Gateway on Friday 26 April.
- These slides form our submission for CAP1616 Step 2B Initial Options Appraisal.

CONTEXT FOR THE CHANGE

1. Bournemouth Airport currently has ILS on both RWY ends
   - 08 (Cat I) – 25% of landings
   - 26 (Cat III) – 75% of landings
2. RWY 08 ILS is obsolete
   - Installed second hand in 1984/5
   - Maintenance support at end of life
   - Irrecoverable failure will have serious operational consequences
3. There is a legal requirement to implement RNP approaches by 2024
   - Could provide 3D capability to both RWYs
   - Could improve resilience to Runway 26 operations.

LIST OF OPTIONS AFTER STAKEHOLDERS ENGAGEMENT

LIST OF OPTIONS AFTER STAKEHOLDERS ENGAGEMENT AND EVALUATION AGAINST DESIGN PRINCIPLES

The following table presents the retained Option 3 following stakeholder engagement. This Option remains equally valid for RWY 08 and RWY 26. It is expected that different Option 3 sub-options may be proposed on RWY 08 and RWY 26 respectively for consultation during Stage 3.

Options	
Option 3	RNP IAP Missed Approach conventional or RNAV to be confirmed during ACP Stage 3
a)	Full T-bar comprising Initial, Intermediate and Final Approach Fixes
b)	Limited T-bar with 1 Initial, Intermediate and Final Approach Fixes
c)	Straight-in with combined Initial/Intermediate and Final Approach Fixes

STEP 2B – INITIAL OPTIONS APPRAISAL

OPTIONS APPRAISAL (PHASE 1 INITIAL)

The following slides contain a qualitative overview of Option 3 and its sub-options including a summary of the concept of operation, with an initial appraisal highlighting the benefits and/or dis-benefits between the sub-options.

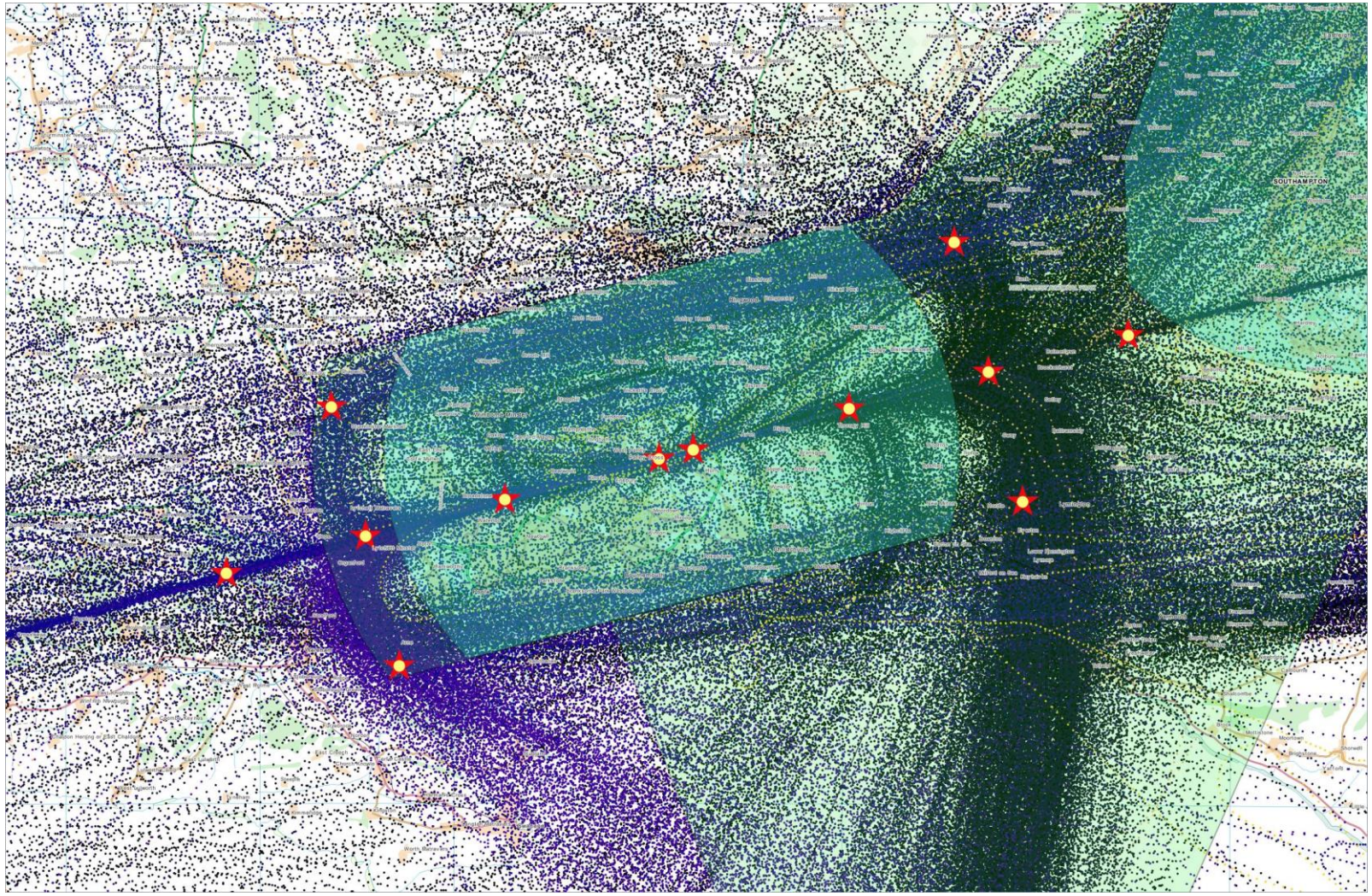
OPTIONS APPRAISAL: INDICATIVE FIXES ON RADAR TRACKS

2017 Traffic Data Filtered for:

- Only Commercial Air Transport and high end General Aviation Operations.

Waypoint positions are **Indicative,** informed by 2017 traffic data, the existing conventional IAPs and PAN-OPS segment lengths. These need to be confirmed during the formal IFPD process during Stage 3.

Waypoint positions are common to all Options, although Options 3b and 3c may not include all waypoints.



INITIAL APPRAISAL: CONCEPT OF OPERATION

To meet Design Principle 9 (*The design shall support continued use of existing radar vectored arrival procedures provided by Solent Radar*), arriving aircraft participating in the RNP Approaches will be vectored by Solent Radar to establish on the Intermediate Segment before the Final Approach Fix.

- Commercial aircraft conducting a missed approach will normally be provided with vectors by Bournemouth radar to re-join the arrival traffic sequence.

Outside of the hours of Solent or Bournemouth Radar services, the published procedure requires aircraft to join overhead BIA NDB and from there to fly in an outbound leg and procedural turn to intercept the ILS. Under the proposed RNP approach aircraft will self position to commence the approach at any Initial Approach Fix, avoiding overhead joins.

It is envisaged that aircraft engaged in training activities who wish to commence an RNP Approach will be required through local instructions to join via a northerly Initial Approach Fix.

- Note the aircraft outbound tracks from the Hold to each northern IAF will be close to, but not replicate, the existing tracks of the ILS, NDB or SRA missed approaches.

Note: RWY 08 RNP Approach is expected to be the preferred approach as it is the only 3D to the RWY. The RWY 26 ILS approach, when available, is expected to remain the preferred approach option to RWY 26.

OPTION 3A: INITIAL APPRAISAL

OPTION 3A

Group	Impact	Level of Analysis	Description
Communities	Noise impact on health and quality of life	Qualitative	Under normal operations where arrivals continue to be radar vectored to the approach, there will be no change to routings or the noise distribution. The precise guidance of the RNP approach will allow improved track keeping compared to an NDB or SRA approach if the ILS is not available, leading to smaller dispersion of the noise footprint. The RNP approach will have lower minima than the NDB or SRA approaches and so if the ILS is not available, it would be expected that the RNP approach would result in fewer missed approaches or diversions than the NDB or SRA approaches and thus lower levels of climb out noise following a missed approach. The out of hours use of an RNP approach with aircraft arriving direct to an IAF will provide a more predictable ground track comparable to the radar vectored operation. Use of a southerly IAF by training aircraft would result in a change in overflights for neighbourhoods south of the runway. This assumes that traffic would route from overhead the aerodrome direct to the IAF in a similar manner as the ILS or NDB approach today. This may result in some perception of increased noise if taken forward.
Communities	Air Quality	Qualitative	Under normal operations where arrivals continue to be radar vectored to the approach, there will be no change to fuel burn, air quality or emissions. The RNP approach will have significantly lower minima than the NDB or SRA approaches and if the ILS is not available, it would be expected that an RNP approach would result in fewer missed approaches or diversions than the NDB or SRA with reduced fuel burn and emissions due to the availability of vertical guidance, and fewer missed approaches. During out of hours operations, where aircraft may fly the full promulgated approach, the RNP approach will result in lower track miles compared to the ILS or NDB approaches with reduced fuel burn, lower emissions and improved air quality. As out of hours operations are a small proportion of the movements at Bournemouth the improvements will be small. Following the implementation of the RNP approach at Bournemouth there may be reduced transit flying by training organisations based at Bournemouth to conduct RNP approach training, with minor reductions in fuel burn and CO2 emissions. (Currently Exeter, Cardiff, Bristol and the Channel Islands have RNP approaches.)

OPTION 3A

Group	Impact	Level of Analysis	Description
Wider Society	Greenhouse gas impact	Qualitative	See above for Air Quality.
Wider Society	Capacity /Resilience	Qualitative	The provision of RNP Approaches will provide capacity and resilience benefits to RWYs 08 and 26 and will have a higher operational availability than can be provided by an ILS, with minimal ongoing operational costs. • For RWY 08, an RNP approach will provide a 3D approach with the LNAV/VNAV minima being lower than the 2D NDB or SRA approaches and the LPV minima being comparable to the CAT I ILS that it will replace. • For RWY 26, the RNP approach will provide operational resilience by providing a 3D approach when the ILS is unavailable.
Wider Society	Tranquillity	Qualitative	The proposed implementation of Option 3A will not change the operational concept for air traffic operations or control at the airport. The vast majority of operations will be vectored by ATC for in accordance with existing practice, and at similar altitudes. Analysis of the traffic arriving at BIA in 2017 showed that approximately 3% of instrument flight operations (including training) flew the published instrument approach procedure. The utilisation of the Option 3A approach will facilitate a more direct approach for aircraft flying the procedure – especially out of hours – with reduced track miles compared to the existing procedures. Of the other traffic at BIA approximately 50% of movements are visual flight rules (VFR) traffic which would not be flying the procedure and are typically lower than other traffic. Thus it is estimated that the introduction of Option 3 will result in a slight improvement to no change in the levels of tranquillity.
Wider Society	Biodiversity	Qualitative	The implementation of the Option 3A is not expected to result in any changes to biodiversity given that the implementation will not require any ground works to support implementation. However, the ILS localiser for RWY 08 is located in a SSI. The impact of decommissioning the localiser is to be discussed in detail with Hampshire County Council, Natural England and the New Forrest National Park during Stage 3 to minimise any disturbance to local flora and fauna. This would have to happen regardless of any option given the end of life status of the RWY 08 ILS. An option might be to leave the antenna concrete plinth and sub surface cables and ducting in situ depending on the recommendation of the above organisations.

OPTION 3A

Group	Impact	Level of Analysis	Description
General Aviation	Access	Qualitative	Business and General aviation fleets have a high level of equipage for RNP approaches with LPV lines of minima. The provision of RNP approaches at Bournemouth is of particular interest to General Aviation operators, particularly with respect to instrument training. The AOPA Response to the Stage 1 engagement included: *"The proposal is supported by AOPA because there is a growing need for GA pilots to train for RNP/PBN procedures and Bournemouth has been and we hope will continue to be a regional airport that continues to welcome General Aviation operations."* The inclusion of an Initial Approach Segment and an RNP Missed approach would increase the range of training scenarios that could be provided at Bournemouth.
General Aviation/ Commercial Air Transport	Economic impact from increased effective capacity	Qualitative	The major economic dis-benefit would be the absence of a 3D approach to RWY 08. There are benefits to the GA and commercial training organisations through the inclusion of an Initial Approach Segments and RNP Missed approaches that would increase the range of training scenarios that could be provided at Bournemouth.

OPTION 3A

Group	Impact	Level of Analysis	Description
General Aviation/ Commercial Air Transport	Fuel burn	Qualitative	The Concept of Operation for the RNP approaches will be to maintain the existing operations as defined in the LoA with Solent Radar with aircraft being 'radar-vectored' to establish on the runway centreline before the Final Approach Fix. Under this scenario, there will be no difference on fuel burn between an ILS or an RNP arrival and approach. Outside of hours of Solent or Bournemouth Radar services, when aircraft may be required to fly the promulgated approach procedure (2017 data suggests approx. 3% of commercial flights fly the published procedure), there will be a benefit through a reduction in track miles if aircraft can route via an Initial Approach Fix without the necessity of flying overhead the BIA NDB. The inclusion of Initial Approach Fixes would enable a fuel burn reduction benefit out of radar hours. The availability of RNP approaches at Bournemouth will result in fuel savings and reduced engine run times for GA training operators through reduced travel times to airports with RNP approaches and the capacity to accept training aircraft. There are known instances of UK training operators travelling to the Channel Islands, France and Belgium to conduct RNP approach training and tests flights. The inclusion of Initial Approach Fixes and an RNP Missed Approach would increase the range of GA training and test exercises that could be provided at Bournemouth leading to fuel burn and operating cost savings from reduced transit flights.

OPTION 3A

Group	Impact	Level of Analysis	Description
Commercial airlines	Training costs	Qualitative	There are no training costs required for commercial operators to participate in the RNP Approach as Regulation (EU) No. 539/2016 Performance Based Navigation (PBN) requires all Pilots who fly PBN routes or procedures to have PBN Endorsement on their licences by 25 August 2018. Engagement with the operators at Bournemouth has confirmed that their aircraft and crew are capable of LNAV and LNAV/VNAV operations. Given the recent publication of Regulation (EU) No. 1048/2018 it is to be expected that commercial operators will introduce LPV capabilities into their fleets. It is noted that EasyJet are the initial customer for LPV capability on the A320 NEO from circa. 2022.
Commercial airlines	Other costs	Qualitative	The availability of a 3D approach to RWY 08 at Bournemouth will lead to fewer minima related diversions and will provide contingency for RWY 26 during periods when the ILS is unavailable (e.g. equipment unserviceability or aerodrome works). The availability of a 3D approach to only one runway end may discourage some aircraft operators from implementing new services.

OPTION 3A

Group	Impact	Level of Analysis	Description
Airport/Air Navigation Service Provider	Infrastructure costs	Qualitative	There are no infrastructure (equipment) costs associated with the RNP approaches are IAP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication.
Airport/Air Navigation Service Provider	Operational costs	Qualitative	The costs of ownership of an RNP approach supported by GNSS is very low compared to a conventional approach requiring the provision of ground navigation aid infrastructure. The RNP approaches require maintenance of the approach procedure on a five yearly basis although there are no ongoing flight inspection activities as would be required for an approach based on conventional navigation infrastructure.
Airport/Air Navigation Service Provider	Deployment costs	Qualitative	There are no deployment costs associated with the RNP approaches are IAP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication.

OPTION 3A INITIAL APPRAISAL: SAFETY CONSIDERATIONS

- There is significant agreement between standardisation bodies, aircraft operators and regulators that the provision of a vertical profile on an instrument approach that facilitates an aircraft to conduct a stabilised approach has a positive impact on safety.
    - Confirmation of the Operational and safety benefits of approaches with vertical guidance are found in the Industry Declaration and the APV implementation resolutions of ICAO General Assembly A36-23 and A37-11, and the EASA PBN Implementing Regulation (EU) 2018/1048.
- This initial appraisal notes that the existing GA training traffic utilise the published IAPs with outbound legs north of the runway before procedural turns to intercept with the ILS for both RWY 08 and RWY 26. The availability of multiple IAFs could lead to integration issues were this practice to change impacting ATC workload and creating potential safety issues.
    - Given the above assessment, it is proposed to limit GA training activities that commence the approach from the hold to join via the northern IAF of RWY 08 under Options 3a.
- This initial appraisal also notes that if an RNP approach to RWY 26 includes an IAF aligned with the final approach track as implied in Option 3a, the IAF would be in close proximity to the Southampton CTR and may adversely impact ATC workload, creating potential safety issues. It is noted that during 2017, there were few arriving aircraft that would utilise an IAF in this location and the IAF would not provide a significant benefit.
    - Given the above assessment, it is planned to discount Option 3a for RWY 26.

OPTION 3B: INITIAL APPRAISAL

OPTION 3B

Group	Impact	Level of Analysis	Description
Communities	Noise impact on health and quality of life	Qualitative	Under normal operations where arrivals continue to be radar vectored to the approach, there will be no change to routings or the noise distribution. The precise guidance of the RNP approach will allow improved track keeping compared to an NDB or SRA approach if the ILS is not available, leading to smaller dispersion of the noise footprint. The RNP approach will have lower minima than the NDB or SRA approaches and so if the ILS is not available, it would be expected that the RNP approach would result in fewer missed approaches or diversions than the NDB or SRA approaches and thus lower levels of climb out noise following a missed approach. The out of hours use of an RNP approach with aircraft arriving direct to an IAF will provide a more predictable ground track comparable to the radar vectored operation. The reduced noise benefit will be most significant if an RNP approach with an Initial Approach Fix is implemented. However, use of a southerly IAF by training aircraft would result in a change in overflights for neighbourhoods south of the runway. This assumes that traffic would route from overhead the aerodrome direct to the IAF in a similar manner as the ILS or NDB approach today. This may result in some perception of increased noise.
Communities	Air Quality	Qualitative	Under normal operations where arrivals continue to be radar vectored to the approach, there will be no change to fuel burn, air quality or emissions. The RNP approach will have significantly lower minima than the NDB or SRA approaches and if the ILS is not available, it would be expected that an RNP approach would result in fewer missed approaches or diversions than the NDB or SRA with reduced fuel burn and emissions due to the availability of vertical guidance, and fewer missed approaches. During out of hours operations, where aircraft may fly the full promulgated approach, the RNP approach will result in lower track miles compared to the ILS or NDB approaches with reduced fuel burn, lower emissions and improved air quality. As out of hours operations are a small proportion of the movements at Bournemouth the improvements will be small. Following the implementation of the RNP approach at Bournemouth there may be reduced transit flying by training organisations based at Bournemouth to conduct RNP approach training, with minor reductions in fuel burn and CO2 emissions. (Currently Exeter, Cardiff, Bristol and the Channel Islands have RNP approaches.) These benefits will be equally applicable, irrespective of which option of RNP approach is implemented.

OPTION 3B

Group	Impact	Level of Analysis	Description
Wider society	Greenhouse gas impact	Qualitative	See above for Air Quality.
Wider Society	Capacity /Resilience	Qualitative	The provision of RNP Approaches will provide capacity and resilience benefits to RWYs 08 and 26 and will have a higher operational availability than can be provided by an ILS, with minimal ongoing operational costs. • For RWY 08, an RNP approach will provide a 3D approach with the LNAV/VNAV minima being lower than the 2D NDB or SRA approaches and the LPV minima being comparable to the CAT I ILS that it will replace. • For RWY 26, the RNP approach will provide operational resilience by providing a 3D approach when the ILS is unavailable. These benefits will be equally applicable, irrespective of which option of RNP approach is implemented.
Wider Society	Tranquillity	Qualitative	The proposed implementation of Option 3B at BIA will not change the operational concept for air traffic operations or control at the airport. The vast majority of operations will be vectored by ATC for in accordance with existing practice, and at similar altitudes. Analysis of the traffic arriving at BIA in 2017 showed that approximately 3% of instrument flight operations (including training) flew the published instrument approach procedure. The utilisation of the Option 3B approach will facilitate a more direct approach for aircraft flying the procedure from either the north or south (depending on IAF orientation) – especially out of hours – with reduced track miles compared to the existing procedures if optimised for southerly approaches. Of the other traffic at BIA approximately 50% of movements are visual flight rules (VFR) traffic which would not be flying the procedure and are typically lower than other traffic. Thus it is estimated that the introduction of Option 3 will result in a slight improvement to no change in the levels of tranquillity.
Wider Society	Biodiversity	Qualitative	The implementation of the Option 3B is not expected to result in any changes to biodiversity given that the implementation will not require any ground works to support implementation. However, the ILS localiser for RWY 08 is located in a SSI. The impact of decommissioning the localiser is to be discussed in detail with Hampshire County Council, Natural England and the New Forrest National Park during Stage 3 to minimise any disturbance to local flora and fauna. This would have to happen regardless of any option given the end of life status of the RWY 08 ILS. An option might be to leave the antenna concrete plinth and sub surface cables and ducting in situ depending on the recommendation of the above organisations.

OPTION 3B

Group	Impact	Level of Analysis	Description
General Aviation	Access	Qualitative	Business and General aviation fleets have a high level of equipage for RNP approaches with LPV lines of minima. The provision of RNP approaches at Bournemouth is of particular interest to General Aviation operators, particularly with respect to instrument training. The AOPA Response to the Stage 1 engagement included: *"The proposal is supported by AOPA because there is a growing need for GA pilots to train for RNP/PBN procedures and Bournemouth has been and we hope will continue to be a regional airport that continues to welcome General Aviation operations."* The inclusion of an Initial Approach Segment and an RNP Missed approach would increase the range of training scenarios that could be provided at Bournemouth.
General Aviation/ Commercial Air Transport	Economic impact from increased effective capacity	Qualitative	The major economic dis-benefit would be the absence of a 3D approach to RWY 08. There are benefits to the GA and commercial training organisations through the inclusion of an Initial Approach Segments and RNP Missed approaches that would increase the range of training scenarios that could be provided at Bournemouth.

OPTION 3B

Group	Impact	Level of Analysis	Description
General Aviation/ Commercial Air Transport	Fuel burn	Qualitative	The Concept of Operation for the RNP approaches will be to maintain the existing operations as defined in the LoA with Solent Radar with aircraft being 'radar-vectored' to establish on the runway centreline before the Final Approach Fix. Under this scenario, there will be no difference on fuel burn between an ILS or an RNP arrival and approach. Outside of hours of Solent or Bournemouth Radar services, when aircraft may be required to fly the promulgated approach procedure (2017 data suggests approx. 3% of commercial flights fly the published procedure), there will be a benefit observed through a reduction in track miles as aircraft can route via an Initial Approach Fix without the necessity of flying overhead the BIA NDB. Depending on where the Initial fix is positioned (either to the North or South) may impact track miles for CAT aircraft which predominantly route from the South. The availability of RNP approaches at Bournemouth will result in fuel savings and reduced engine run times for GA training operators through reduced travel times to airports with RNP approaches and the capacity to accept training aircraft. There are known instances of UK training operators travelling to the Channel Islands, France and Belgium to conduct RNP approach training and tests flights. The inclusion of Initial Approach Fix and an RNP Missed Approach would increase the range of GA training and test exercises that could be provided at Bournemouth leading to fuel burn and operating cost savings from reduced transit flights.

OPTION 3B

Group	Impact	Level of Analysis	Description
Commercial airlines	Training costs	Qualitative	There are no training costs required for commercial operators to participate in the RNP Approach as Regulation (EU) No. 539/2016 Performance Based Navigation (PBN) requires all Pilots who fly PBN routes or procedures to have PBN Endorsement on their licences by 25 August 2018. Engagement with the operators at Bournemouth has confirmed that their aircraft and crew are capable of LNAV and LNAV/VNAV operations. Given the recent publication of Regulation (EU) No. 1048/2018 it is to be expected that commercial operators will introduce LPV capabilities into their fleets. It is noted that EasyJet are the initial customer for LPV capability on the A320 NEO from circa. 2022. There will be no impact on training costs from any of the options for RNP approaches at Bournemouth.
Commercial airlines	Other costs	Qualitative	The availability of a 3D approach to RWY 08 at Bournemouth will lead to fewer minima related diversions and will provide contingency for RWY 26 during periods when the ILS is unavailable (e.g. equipment unserviceability or aerodrome works). The availability of a 3D approach to only one runway end may discourage some aircraft operators from implementing new services. There is no advantage of any of the options of RNP approach under consideration.

OPTION 3B

Group	Impact	Level of Analysis	Description
Airport/Air Navigation Service Provider	Infrastructure costs	Qualitative	There are no infrastructure (equipment) costs associated with the RNP approaches are IAP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication.
Airport/Air Navigation Service Provider	Operational costs	Qualitative	The costs of ownership of an RNP approach supported by GNSS is very low compared to a conventional approach requiring the provision of ground navigation aid infrastructure. The RNP approaches require maintenance of the approach procedure on a five yearly basis although there are no ongoing flight inspection activities as would be required for an approach based on conventional navigation infrastructure.
Airport/Air Navigation Service Provider	Deployment costs	Qualitative	There are no deployment costs associated with the RNP approaches are IAP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication.

OPTION 3B INITIAL APPRAISAL: SAFETY CONSIDERATIONS

- There is significant agreement between standardisation bodies, aircraft operators and regulators that the provision of a vertical profile on an instrument approach that facilitates an aircraft to conduct a stabilised approach has a positive impact on safety.
    - Confirmation of the Operational and safety benefits of approaches with vertical guidance are found in the Industry Declaration and the APV implementation resolutions of ICAO General Assembly A36-23 and A37-11, and the EASA PBN Implementing Regulation (EU) 2018/1048.
- This initial appraisal notes that the existing GA training traffic utilises the published IAPs with outbound legs north of the runway before procedural turns to intercept with the ILS. The availability of a single southern IAFs could lead to integration issues were this practice to change impacting ATC workload and creating potential safety issues.
    - Given the above assessment, it may not be possible for GA to use the IAF for training whilst there is CAT approaching Bournemouth airport for RWY 08 or RWY 26 under Option 3b.

OPTION 3C: INITIAL APPRAISAL

OPTION 3C

Group	Impact	Level of Analysis	Description
Communities	Noise impact on health and quality of life	Qualitative	Under normal operations where arrivals continue to be radar vectored to the approach, there will be no change to routings or the noise distribution. The precise guidance of the RNP approach will allow improved track keeping compared to an NDB or SRA approach if the ILS is not available, leading to smaller dispersion of the noise footprint. The RNP approach will have lower minima than the NDB or SRA approaches and so if the ILS is not available, it would be expected that the RNP approach would result in fewer missed approaches or diversions than the NDB or SRA approaches and thus lower levels of climb out noise following a missed approach. The out of hours use of an RNP approach with aircraft arriving direct to an IAF will provide a more predictable ground track comparable to the radar vectored operation.
Communities	Air Quality	Qualitative	Under normal operations where arrivals continue to be radar vectored to the approach, there will be no change to fuel burn, air quality or emissions. The RNP approach will have significantly lower minima than the NDB or SRA approaches and if the ILS is not available, it would be expected that an RNP approach would result in fewer missed approaches or diversions than the NDB or SRA with reduced fuel burn and emissions due to the availability of vertical guidance, and fewer missed approaches. During out of hours operations, where aircraft may fly the full promulgated approach, the RNP approach will result in lower track miles compared to the ILS or NDB approaches with reduced fuel burn, lower emissions and improved air quality. As out of hours operations are a small proportion of the movements at Bournemouth the improvements will be small. Following the implementation of the RNP approach at Bournemouth there may be reduced transit flying by training organisations based at Bournemouth to conduct RNP approach training, with minor reductions in fuel burn and CO2 emissions. (Currently Exeter, Cardiff, Bristol and the Channel Islands have RNP approaches.)

OPTION 3C

Group	Impact	Level of Analysis	Description
Wider society	Greenhouse gas impact	Qualitative	See above for Air Quality.
Wider Society	Capacity /Resilience	Qualitative	The provision of RNP Approaches will provide capacity and resilience benefits to RWYs 08 and 26 and will have a higher operational availability than can be provided by an ILS, with minimal ongoing operational costs. • For RWY 08, an RNP approach will provide a 3D approach with the LNAV/VNAV minima being lower than the 2D NDB or SRA approaches and the LPV minima being comparable to the CAT I ILS that it will replace. • For RWY 26, the RNP approach will provide operational resilience by providing a 3D approach when the ILS is unavailable.
Wider Society	Tranquillity	Qualitative	The proposed implementation of Option 3C at BIA will not change the operational concept for air traffic operations or control at the airport. The vast majority of operations will be vectored by ATC for in accordance with existing practice, and at similar altitudes. Analysis of the traffic arriving at BIA in 2017 showed that approximately 3% of instrument flight operations (including training) flew the published instrument approach procedure. The utilisation of the Option 3C approach will facilitate a more direct approach for aircraft flying the procedure – especially out of hours – with reduced track miles compared to the existing procedures. Of the other traffic at BIA approximately 50% of movements are visual flight rules (VFR) traffic which would not be flying the procedure and are typically lower than other traffic. Thus it is estimated that the introduction of Option 3 will result in a slight improvement to no change in the levels of tranquillity.
Wider Society	Biodiversity	Qualitative	The implementation of the Option 3C is not expected to result in any changes to biodiversity given that the implementation will not require any ground works to support implementation. However, the ILS localiser for RWY 08 is located in a SSI. The impact of decommissioning the localiser is to be discussed in detail with Hampshire County Council, Natural England and the New Forrest National Park during Stage 3 to minimise any disturbance to local flora and fauna. This would have to happen regardless of any option given the end of life status of the RWY 08 ILS. An option might be to leave the antenna concrete plinth and sub surface cables and ducting in situ depending on the recommendation of the above organisations.

OPTION 3C

Group	Impact	Level of Analysis	Description
General Aviation	Access	Qualitative	Business and General aviation fleets have a high level of equipage for RNP approaches with LPV lines of minima. The provision of RNP approaches at Bournemouth is of particular interest to General Aviation operators, particularly with respect to instrument training. The AOPA Response to the Stage 1 engagement included: *"The proposal is supported by AOPA because there is a growing need for GA pilots to train for RNP/PBN procedures and Bournemouth has been and we hope will continue to be a regional airport that continues to welcome General Aviation operations."* Without the inclusion of an Initial Approach Segment and an RNP Missed approach, the range of training scenarios that could be provided at Bournemouth would be more limited.
General Aviation/ Commercial Air Transport	Economic impact from increased effective capacity	Qualitative	The major economic dis-benefit would be the absence of a 3D approach to RWY 08. There are benefits to the GA and commercial training organisations through the inclusion of an Initial Approach Segments and RNP Missed approaches that would increase the range of training scenarios that could be provided at Bournemouth however with this option, the benefit would not be realised.

OPTION 3C

Group	Impact	Level of Analysis	Description
General Aviation/ Commercial Air Transport	Fuel burn	Qualitative	The Concept of Operation for the RNP approaches will be to maintain the existing operations as defined in the LoA with Solent Radar with aircraft being 'radar-vectored' to establish on the runway centreline before the Final Approach Fix. Under this scenario, there will be no difference on fuel burn between an ILS or an RNP arrival and approach. Outside of hours of Solent or Bournemouth Radar services, when aircraft may be required to fly the promulgated approach procedure (2017 data suggests approx. 3% of commercial flights fly the published procedure), there will be a benefit through a reduction in track miles if aircraft can route via an Initial Approach Fix without the necessity of flying overhead the BIA NDB. This will not be realised with Option 3C as aircraft would not be able to conduct this procedure outside of normal operating hours.
Commercial airlines	Training costs	Qualitative	There are no training costs required for commercial operators to participate in the RNP Approach as Regulation (EU) No. 539/2016 Performance Based Navigation (PBN) requires all Pilots who fly PBN routes or procedures to have PBN Endorsement on their licences by 25 August 2018. Engagement with the operators at Bournemouth has confirmed that their aircraft and crew are capable of LNAV and LNAV/VNAV operations. Given the recent publication of Regulation (EU) No. 1048/2018 it is to be expected that commercial operators will introduce LPV capabilities into their fleets. It is noted that EasyJet are the initial customer for LPV capability on the A320 NEO from circa. 2022.
Commercial airlines	Other costs	Qualitative	The availability of a 3D approach to RWY 08 at Bournemouth will lead to fewer minima related diversions and will provide contingency for RWY 26 during periods when the ILS is unavailable (e.g. equipment unserviceability or aerodrome works). The availability of a 3D approach to only one runway end may discourage some aircraft operators from implementing new services.

OPTION 3C

Group	Impact	Level of Analysis	Description
Airport/Air Navigation Service Provider	Infrastructure costs	Qualitative	There are no infrastructure (equipment) costs associated with the RNP approaches are IAP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication.
Airport/Air Navigation Service Provider	Operational costs	Qualitative	The costs of ownership of an RNP approach supported by GNSS is very low compared to a conventional approach requiring the provision of ground navigation aid infrastructure. The RNP approaches require maintenance of the approach procedure on a five yearly basis although there are no ongoing flight inspection activities as would be required for an approach based on conventional navigation infrastructure.
Airport/Air Navigation Service Provider	Deployment costs	Qualitative	There are no deployment costs associated with the RNP approaches are IAP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication.

OPTION 3C INITIAL APPRAISAL: SAFETY CONSIDERATIONS

- There is significant agreement between standardisation bodies, aircraft operators and regulators that the provision of a vertical profile on an instrument approach that facilitates an aircraft to conduct a stabilised approach has a positive impact on safety.
    - Confirmation of the Operational and safety benefits of approaches with vertical guidance are found in the Industry Declaration and the APV implementation resolutions of ICAO General Assembly A36-23 and A37-11, and the EASA PBN Implementing Regulation (EU) 2018/1048.
- This initial appraisal notes that the existing GA training traffic utilises the published IAPs with outbound legs north of the runway before procedural turns to intercept with the ILS. Under Option 3C, positioning for the IAP would be either through self positioning or ATC vectoring to avoid safety issues with CAT.

INITIAL APPRAISAL: FURTHER EXAMINATION

SAFETY CONSIDERATIONS

- As a result of the identified potential safety considerations applied during Stage 2B, it has become apparent that another viable option exists which may mitigate against the safety impact of the limited T-bar (Option 3b). As this was identified within Stage 2B (after testing with stakeholders as part of Stage 2A), it has been decided that this new option will be evaluated against the design principles and be included within the initial options appraisal submission. The stakeholders will be consulted on the remaining viable options following the full options appraisal where they are able to provide feedback on the new option if it is taken forward to consultation. This option is identified as Option 3d – containing both **northern and southern** IAFs.
- This initial appraisal concludes that the safety of a correctly designed RNP Approach at Bournemouth can be demonstrated to be safe through a Safety Case.

ALIGNMENT OF OPTION 3D WITH DESIGN PRINCIPLES

The table below presents an initial assessment of how each option addresses the design principles requirements.

Design Principles	Options
	Option 3D
1. The new procedures should not increase the number of people overflown by aircraft participating in the approach	**OK**
2. The new procedures should not increase the noise footprint of the existing airport operation, for similar aircraft types and traffic levels, as detailed in the LAeq 16 Hr map in the current Noise Action Plan.	**OK**
3. Implementation should minimise disturbance to the Moors River System SSSI.	**OK**
4. The new approaches shall be standardised by ICAO and acceptable to EASA and CAA and the implementation shall be in compliance with all applicable legislation and regulations	**OK**
5. The design shall be fully compliant with the design criteria stated in ICAO Doc 8168 (PANS OPS) and be flyable by all aircraft types in approach Speed Categories A through D.	**OK**
6. The approach procedures shall be of a type for which the majority of Bournemouth aircraft operators are equipped and authorised to fly.	**OK**
7. The designs shall seamlessly integrate with extant instrument approach procedures at Bournemouth International Airport	**OK**
8. The procedures should address the needs of flight training operators at Bournemouth	**OK**
9. The design shall support continued use of existing radar vectored arrival procedures provided by Solent Radar.	**OK**
10. The new procedures shall be implemented in a cost-effective manner.	**OK**

OPTION 3D: INITIAL APPRAISAL

OPTION 3D

Group	Impact	Level of Analysis	Description
Communities	Noise impact on health and quality of life	Qualitative	Under normal operations where arrivals continue to be radar vectored to the approach, there will be no change to routings or the noise distribution. The precise guidance of the RNP approach will allow improved track keeping compared to an NDB or SRA approach if the ILS is not available, leading to smaller dispersion of the noise footprint. The RNP approach will have lower minima than the NDB or SRA approaches and so if the ILS is not available, it would be expected that the RNP approach would result in fewer missed approaches or diversions than the NDB or SRA approaches and thus lower levels of climb out noise following a missed approach. The out of hours use of an RNP approach with aircraft arriving direct to an IAF will provide a more predictable ground track comparable to the radar vectored operation. The reduced noise benefit will be most significant if an RNP approach with an Initial Approach Fix is implemented. However, use of the southerly IAF by training aircraft would result in a change in overflights for neighbourhoods south of the runway. This assumes that traffic would route from overhead the aerodrome direct to the IAF in a similar manner as the ILS or NDB approach today. This may result in some perception of increased noise.
Communities	Air Quality	Qualitative	Under normal operations where arrivals continue to be radar vectored to the approach, there will be no change to fuel burn, air quality or emissions. The RNP approach will have significantly lower minima than the NDB or SRA approaches and if the ILS is not available, it would be expected that an RNP approach would result in fewer missed approaches or diversions than the NDB or SRA with reduced fuel burn and emissions due to the availability of vertical guidance, and fewer missed approaches. During out of hours operations, where aircraft may fly the full promulgated approach, the RNP approach will result in lower track miles compared to the ILS or NDB approaches with reduced fuel burn, lower emissions and improved air quality. As out of hours operations are a small proportion of the movements at Bournemouth the improvements will be small. Following the implementation of the RNP approach at Bournemouth there may be reduced transit flying by training organisations based at Bournemouth to conduct RNP approach training, with minor reductions in fuel burn and CO2 emissions. (Currently Exeter, Cardiff, Bristol and the Channel Islands have RNP approaches.)

OPTION 3D

Group	Impact	Level of Analysis	Description
Wider society	Greenhouse gas impact	Qualitative	See above for Air Quality.
Wider Society	Capacity /Resilience	Qualitative	The provision of RNP Approaches will provide capacity and resilience benefits to RWYs 08 and 26 and will have a higher operational availability than can be provided by an ILS, with minimal ongoing operational costs. • For RWY 08, an RNP approach will provide a 3D approach with the LNAV/VNAV minima being lower than the 2D NDB or SRA approaches and the LPV minima being comparable to the CAT I ILS that it will replace. • For RWY 26, the RNP approach will provide operational resilience by providing a 3D approach when the ILS is unavailable.
Wider Society	Tranquillity	Qualitative	The proposed implementation of Option 3d at BIA will not change the operational concept for air traffic operations or control at the airport. The vast majority of operations will be vectored by ATC for in accordance with existing practice, and at similar altitudes. Analysis of the traffic arriving at BIA in 2017 showed that approximately 3% of instrument flight operations (including training) flew the published instrument approach procedure. The utilisation of the Option 3d approach will facilitate a more direct approach for aircraft flying the procedure – especially out of hours – with reduced track miles compared to the existing procedures. Of the other traffic at BIA approximately 50% of movements are visual flight rules (VFR) traffic which would not be flying the procedure and are typically lower than other traffic. Thus it is estimated that the introduction of Option 3 will result in a slight improvement to no change in the levels of tranquillity.
Wider Society	Biodiversity	Qualitative	The implementation of the Option 3d is not expected to result in any changes to biodiversity given that the implementation will not require any ground works to support implementation. However, the ILS localiser for RWY 08 is located in a SSI. The impact of decommissioning the localiser is to be discussed in detail with Hampshire County Council, Natural England and the New Forrest National Park during Stage 3 to minimise any disturbance to local flora and fauna. This would have to happen regardless of any option given the end of life status of the RWY 08 ILS. An option might be to leave the antenna concrete plinth and sub surface cables and ducting in situ depending on the recommendation of the above organisations.

OPTION 3D

Group	Impact	Level of Analysis	Description
General Aviation	Access	Qualitative	Business and General aviation fleets have a high level of equipage for RNP approaches with LPV lines of minima. The provision of RNP approaches at Bournemouth is of particular interest to General Aviation operators, particularly with respect to instrument training. The AOPA Response to the Stage 1 engagement included: *"The proposal is supported by AOPA because there is a growing need for GA pilots to train for RNP/PBN procedures and Bournemouth has been and we hope will continue to be a regional airport that continues to welcome General Aviation operations."* Without the inclusion of an Initial Approach Segment and an RNP Missed approach, the range of training scenarios that could be provided at Bournemouth would remain the same.
General Aviation/ Commercial Air Transport	Economic impact from increased effective capacity	Qualitative	The major economic dis-benefit would be the absence of a 3D approach to RWY 08. There are benefits to the GA and commercial training organisations through the inclusion of an Initial Approach Segments and RNP Missed approaches that would increase the range of training scenarios that could be provided at Bournemouth however with this option, the benefit would not be realised.

OPTION 3D

Group	Impact	Level of Analysis	Description
General Aviation/ Commercial Air Transport	Fuel burn	Qualitative	The Concept of Operation for the RNP approaches will be to maintain the existing operations as defined in the LoA with Solent Radar with aircraft being 'radar-vectored' to establish on the runway centreline before the Final Approach Fix. Under this scenario, there will be no difference on fuel burn between an ILS or an RNP arrival and approach. Outside of hours of Solent or Bournemouth Radar services, when aircraft may be required to fly the promulgated approach procedure (2017 data suggests approx. 3% of commercial flights fly the published procedure), there will be a benefit through a reduction in track miles if aircraft can route via an Initial Approach Fix without the necessity of flying overhead the BIA NDB. The inclusion of Initial Approach Fixes would enable a fuel burn reduction benefit out of radar hours. The availability of RNP approaches at Bournemouth will result in fuel savings and reduced engine run times for GA training operators through reduced travel times to airports with RNP approaches and the capacity to accept training aircraft. There are known instances of UK training operators travelling to the Channel Islands, France and Belgium to conduct RNP approach training and tests flights. The inclusion of Initial Approach Fixes and an RNP Missed Approach would increase the range of GA training and test exercises that could be provided at Bournemouth leading to fuel burn and operating cost savings from reduced transit flights.

OPTION 3D

Group	Impact	Level of Analysis	Description
Commercial airlines	Training costs	Qualitative	There are no training costs required for commercial operators to participate in the RNP Approach as Regulation (EU) No. 539/2016 Performance Based Navigation (PBN) requires all Pilots who fly PBN routes or procedures to have PBN Endorsement on their licences by 25 August 2018. Engagement with the operators at Bournemouth has confirmed that their aircraft and crew are capable of LNAV and LNAV/VNAV operations. Given the recent publication of Regulation (EU) No. 1048/2018 it is to be expected that commercial operators will introduce LPV capabilities into their fleets. It is noted that EasyJet are the initial customer for LPV capability on the A320 NEO from circa. 2022.
Commercial airlines	Other costs	Qualitative	The availability of a 3D approach to RWY 08 at Bournemouth will lead to fewer minima related diversions and will provide contingency for RWY 26 during periods when the ILS is unavailable (e.g. equipment unserviceability or aerodrome works). The availability of a 3D approach to only one runway end may discourage some aircraft operators from implementing new services.

OPTION 3D

Group	Impact	Level of Analysis	Description
Airport/Air Navigation Service Provider	Infrastructure costs	Qualitative	There are no infrastructure (equipment) costs associated with the RNP approaches are IAP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication.
Airport/Air Navigation Service Provider	Operational costs	Qualitative	The costs of ownership of an RNP approach supported by GNSS is very low compared to a conventional approach requiring the provision of ground navigation aid infrastructure. The RNP approaches require maintenance of the approach procedure on a five yearly basis although there are no ongoing flight inspection activities as would be required for an approach based on conventional navigation infrastructure.
Airport/Air Navigation Service Provider	Deployment costs	Qualitative	There are no deployment costs associated with the RNP approaches are IAP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication.

OPTION 3D INITIAL APPRAISAL: SAFETY CONSIDERATIONS

- There is significant agreement between standardisation bodies, aircraft operators and regulators that the provision of a vertical profile on an instrument approach that facilitates an aircraft to conduct a stabilised approach has a positive impact on safety.
    - Confirmation of the Operational and safety benefits of approaches with vertical guidance are found in the Industry Declaration and the APV implementation resolutions of ICAO General Assembly A36-23 and A37-11, and the EASA PBN Implementing Regulation (EU) 2018/1048.
- This initial appraisal notes that the existing GA training traffic utilises the published IAPs with outbound legs north of the runway before procedural turns to intercept with the ILS. The availability of multiple IAFs could lead to integration issues were this practice to change (i.e. utilisation of the southern IAF by GA training flights) impacting ATC workload and creating potential safety issues.
    - Given the above assessment, it is proposed to limit GA training activities that commence the approach from the hold to join via the northern IAF of RWY 08 or RWY 26 if available under Options 3D.

OPTION 3 INITIAL APPRAISAL: COMPARISON OF SUB-OPTIONS

GROUP	IMPACT	OPTION 3a Full T-bar	OPTION 3b Limited T-bar: 1 IAF	OPTION 3c 'Straight-in'	OPTION 3d Limited T-bar: 2 IAFs	Benefit or Dis-Benefit
Community	**Noise impact on health and quality of life**	=	—	—	=	IAF for arrivals provide a predictable initial approach
Community	**Air Quality**	=	=	=	=	
Wider Society	**Air Quality and Greenhouse gas impact**	=	=	=	=	
Wider Society	**Capacity /resilience**	=	=	=	=	
General Aviation	**Access**	+	+	—	+	Initial approach segment increases training scenarios
General Aviation/ commercial airlines	**Economic impact from increased effective capacity**	+	+	—	+	
General Aviation/ commercial airlines	**Fuel Burn**	+	+	—	+	Non-Radar, lower miles compared to Prom ILS approach Fewer transit flights if local RNP approach available.
Commercial airlines	**Training costs**	=	=	=	=	
Commercial airlines	**Other costs**	=	=	=	=	
Airport/ANSP	**Infrastructure costs**	=	=	=	=	
Airport/ANSP	**Operational costs**	=	=	=	=	
Airport/ANSP	**Deployment costs**	=	=	=	=	
	Safety	—	—	=	=	Proximity of RWY 26 'central IAF' to Southampton CTR and single IAF for both GA and CAT

= No difference between Options + Positive benefit — Dis-benefit

CONCLUSIONS

CONCLUSION

- BIA has followed the CAP 1616 Stage 2A and 2B Process.
- The Comprehensive List of Options were:
    1. Do Nothing;
    2. Install new CAT I ILS on RWY 08;
    3. RNP IAP (missed Approach conventional or RNAV to be confirmed during ACP Stage 3):
        - Full T-bar comprising Initial, Intermediate and Final Approach Fixes;
        - Limited T-bar with 1 Initial, Intermediate and Final Approach Fixes
        - Straight-in with combined Initial/Intermediate and Final Approach Fixes
- BIA engaged with its local aeronautical stakeholders, Airport Consultative Committee and selected NATMAC organisations to test the list of options that addressed the Statement of Need and that aligned with Design Principles on 23 May 2019 via email.
- The Options 1 and 2 were discounted in Step 2A and their exclusion was accepted by all stakeholders. These Options do not deliver against the Statement of Need and they are not aligned with the Design Principles.
- BIA completed the Initial Options Appraisal for Option 3 and all its sub-options. After the Initial Options Appraisal, BIA has discounted Option 3a for RWY 26. However, a fourth option (RNP IAP – Limited T-bar with 2 Initial Approach Fixes) has been identified following review of the safety considerations.