# **CAA Operational Assessment**

Title of airspace change proposal	Kemble RNAV Approaches	
Change sponsor	Kemble Air Services	
Project no.	ACP-2016-18	
SARG project leader		
Case study commencement date	21 Aug 2020	
Case study report as at	21 Oct 2020 UPDATED 11 Dec 2020	
Instructions		
In providing a response for each question, please ensure that	t the 'status' column is completed using the following options:	
• yes • no • partially • n/a		
To aid the SARG project leader's efficient project management what is:	nt it may be useful that each question is also highlighted accordingly to illustrate	
resolved Green not resolved Amber not compliantRe	ed	

#### **Executive Summary**

Kemble first started investigating GNSS approaches in 2010; however, concerted efforts were made in 2016 where a gap analysis was conducted against CAP1122, and a CAP725 ACP Framework Meeting was held. This work stalled in 2017 due to a number of issues, including rising consultancy costs and uncertainty regarding the transition from CAP725 to the proposed new process (what is now CAP1616).

A new airport manager was appointed in 2018 who revived the efforts to introduce GNSS approaches with the submission of a revised Statement of Need. The CAA determined that the Kemble ACP should transition to CAP1616 and that the newly developed bow-tie questionnaire should be completed.

The ACP proposes the introduction of an RNP approach to each runway end (RW26 and RW08) to support CAT B-D Maintenance Repair Organisation (MRO) movements and other corporate/non-recreational activities such as business jets and royal flights, including CAT-A aircraft. These flights already take place today and this ACP is not expected to lead to an increase in movements of itself except facilitating some arrivals that might not have been possible due to weather. The in-scope movements account for less than 1% of the total annual movements, with pre-COVID estimations of approximately 250 approaches per year.

Whilst the output of the proposal is the development of suitable IAPs, consideration of the operation needs to be made given that the aerodrome provides a FIS without approach control, where an understanding of how the in-scope aircraft will integrate with circa 30,000 (per annum) other movements is required. An exemption to Article 183 of the ANO is required to support the changes in operation at Kemble.

The Sponsor originally submitted their final proposal on 17 Jul 2020; however, there were a few matters that required amendment or clarification that lead to a revised submission, which was submitted to the CAA on 20 Aug 2020. The revisions do not materially affect the nature of the proposal. This assessment is based on the revised submission.

On 6 Oct 2020 the CAA informed the Sponsor that the justification for not including holds in the IAP designs was not satisfactory. A supplementary document was requested that addressed the CAA's concerns and provided greater clarity regarding the operation of the IAPs. This additional document was received on 19 Oct 2020, followed by a revised Pilot Brief on 20 Oct 2020.

#### UPDATE 11 DEC 2020

During the CAA review of the proposal, the CAA identified in the document set two different versions of the missed approach for Runway 26. The main submission document included a diagram used in previous stages, including the consultation, where the outbound leg of the missed approach was 4.8nm, whereas the technical draft designs in Annex C presented an outbound leg of 7.5nm. The CAA asked the Sponsor to submit a supplementary document to clarify the issue, which was received on 2 Dec 2020.

1.	Justification for change and options analysis (operational/technical)	Status
1.1	Is the explanation of the proposed change clear and understood?	YES
	The Sponsor describes the proposed change as introducing defined instrument approaches mostly within Class G airs extending into the surrounding area for approximately 15nm. The approaches are intended to formalise activity that where the approaches are currently determined by the pilot.	•
1.2	Are the reasons for the change stated and acceptable?	YES
	<ul> <li>The proposal aims to achieve:</li> <li>Improved safety, regularity and accuracy of in-scope arrivals on a defined terrain-safe approach.</li> <li>Reduced cockpit workload for in-scope aircraft on approach.</li> <li>Improved ability to conduct successful approaches in IMC.</li> </ul>	
1.3	Have all appropriate alternative options been considered, including the 'do nothing' option?	YES
	Through engagement and analysis, with one option eliminated in Stage 2, two options were presented for Stage 3 col'do nothing'; however, as RNP approaches are required to follow ICAO design criteria, there was little to differentiate options for the introduction of instrument procedures.	_
1.4	Is the justification for the selection of the proposed option sound and acceptable?	YES
	There is little to differentiate between the options considered; however, the final submission presents a refined versi was modified following comments received during consultation regarding raising the altitude for the missed approach were supportive of the proposal but were agnostic of the preferred option; there was slightly more support for option to be better for integration with RAF Brize Norton and RAF Fairford.	h. Many consultees

2.	Airspace description and operational arrangements	Status	
2.1	Is the type of proposed airspace design clearly stated and understood?	YES	
	The IAPs have been designed to broadly replicate current behaviours whilst taking into account local airspace and other descriptions of the change are not succinct and mix technical and non-technical language but are satisfactory. The track are presented on a suitable chart but would have benefited from having a non-technical overlay so that it was clearer to aviation background how they might be affected. Diagrams in other documents from previous stages are clearer.	s over the ground	
2.2	Are the hours of operation of the airspace and any seasonal variations stated and acceptable?	YES	
	The IAPs will be operated up to a maximum of 5 times per day in defined time slots and with no changes to existing airful No significant changes to current aircraft movements are anticipated as a result of the introduction of IAPs.	ield operating hours.	
2.3	Is any interaction with adjacent domestic and international airspace structures stated and acceptable including an explanation of how connectivity is to be achieved? Has the agreement of adjacent States been secured in respect of High Seas airspace changes?	YES	
	Kemble's connectivity with the domestic route structure through Class G airspace is described but is not changing as a r proposal. There are no High Seas or other international considerations.	s a result of this	
2.4	Is the supporting statistical evidence relevant and acceptable?	YES	
	Given the class of airspace and nature of aircraft operations in the affected area, it has not been feasible for the Sponso data on the movement of aircraft other than those operating to/from Kemble. Quantitative data provided on current armovements (both in-scope and out-of-scope) is satisfactory. Satisfactory qualitative information has been provided for the proposal.	nd forecast Kemble	

2.5	Is the analysis of the impact of the traffic mix on complexity and workload of operations complete and satisfactory?	YES
	The traffic mix (flight rules, task, aircraft types) does not change as a result of this proposal. However, the integration of FIS aerodrome requires changes to operational procedures. The Sponsor has presented a risk assessment, revised procedure and a draft amendment to the AIP to articulate how the mix of traffic will be managed.	•
2.6	Are any draft Letters of Agreement and/or Memoranda of Understanding included and, if so, do they contain the commitments to resolve ATS procedures (ATSD) and airspace management requirements?	PARTIALLY
	Draft LOAs have been provided but these need to be reviewed to remove references to denying access to the ATZ, which with the responsibilities of the AFIS license. This has been discussed with the Sponsor, but some references have been manual amending the documents. The LOAs also need to be signed before implementation of the IAPs.	
2.7	Should there be any other aviation activity (low flying, gliding, parachuting, microlight site etc) in the vicinity of the new airspace structure and no suitable operating agreements or ATC Procedures can be devised, what action has the change sponsor carried out to resolve any conflicting interests?	N/A
	The ACP has considered other aviation activity and the proposed IAPs lie mostly within Class G airspace – interactions wi and local gliding clubs are already considered in Kemble's current operation through LOAs. The revised draft LOA with RA considers those parts of the IAPs that lie within the Brize CTR. The Kemble Pilot Brief provides details on the integration Fairford operations. The revised draft LOA with the gliding clubs is largely unchanged with the introduction of the IAPs.	AF Brize Norton

2.8	Is the evidence that the airspace design is compliant with ICAO SARPs, airspace design & FUA regulations, and Eurocontrol guidance satisfactory?
	IAPs are subject to IFP review. 11 Dec 2020: IFP review complete.  The Sponsor proposes IAPs that do not include the provision of holds. The justification for this is provided in the proposal but this was not been accepted in its entirety. A supplementary document was provided that, along with a revised Pilot Brief, presents a clear picture of th operation and why the Sponsor does not wish to introduce holds in the IAPs. The argument for/against hold, for adjudication by AAA Management team.
2.9	Is the proposed airspace classification stated and justification for that classification acceptable?  YES
	There are no changes to airspace classification.
2.10	Within the constraints of safety and efficiency, does the airspace classification permit access to as many classes of user as practicable?
	The Sponsor states in the main proposal document that they will operate within the limitations of the AFIS licence, but, as per 2.6, references to closing, restricting, limiting access to the ATZ should be removed before the IAPs are implemented. This has been discussed with the Sponsor who has amended some aspects but it would appear that some others have been missed.
2.11	Is there assurance, as far as practicable, against unauthorised incursions? (This is usually done through the classification and promulgation.)
	There is no change in airspace classification, the ATZ is already published, IAP chevrons will be added to the VFR chart to warn other airspace users.

2.12	Is there a commitment to allow access to all airspace users seeking a transit through controlled airspace as per the classification, or in the event of such a request being denied, a service around the affected area?	PARTIALLY
	This ACP does not propose any changes to classification of airspace. On direction from the CAA the Sponsor has amend documents to confirm that the pre-existing ATZ will be operated in accordance with the AFISO license. However, some the ATZ and denying access remain; these will need to be amended prior to implementation of the IAPs (see 2.5).	
2.13	Are appropriate arrangements for transiting aircraft in place in accordance with stated commitments?	PARTIALLY
	Current procedures for crossing the ATZ remain but see 2.12 above re closing the ATZ. The IAPs sit mostly within Class Sponsor has no responsibilities for transit flights; however, they will provide traffic information to transit aircraft on re-	•
2.14	Are any airspace user group's requirements not met?	NO
	Other airspace users' requirements were considered during the development of the ACP. The design of the preferred of the requirements of other airspace users and local ANSPs.	ption was influenced
2.15	Is any delegation of ATS justified and acceptable? (If yes, refer to Delegated ATS Procedure).	N/A
	Kemble is an AFIS unit with an LOA with nearby RAF Brize Norton for the provision of a LARS when able and CTR crossin required. Brize also assists with Kemble departures wishing to join airways. There are no arrangements for delegated A	•

2.16	Is the airspace design of sufficient dimensions with regard to expected aircraft navigation performance and manoeuvrability to contain horizontal and vertical flight activity (including holding patterns) and associated protected areas in both radar and non-radar environments?	YES
	The ACP is limited to the design of the IAPs, with no changes to existing structures or addition of any new ones. The IAPs designed to take account of in-scope aircraft performance (subject to IFP check). 11 Dec 2020: IFP review complete.	have been
2.17	Have all safety buffer requirements (or mitigation of these) been identified and described satisfactorily (to be in accordance with the agreed parameters or show acceptable mitigation)? (Refer to buffer policy letter.)	N/A
	There is no requirement for safety buffers for airspace design as described in the CAA Policy Statement.	
2.18	Do ATC procedures ensure the maintenance of prescribed separation between traffic inside a new airspace structure and traffic within existing adjacent or other new airspace structures?	N/A
	Kemble will remain an AFIS unit in Class G airspace and it is not their responsibility to provide separation. ATS procedures developed to reduce/eliminate risks associated with more than one aircraft conducting an instrument approach at the sa introduction of slot times), and to mitigate the risk of integration issues with the VFR operation and other IFR traffic.	
2.19	Is the airspace structure designed to ensure that adequate and appropriate terrain clearance can be readily applied within and adjacent to the proposed airspace?	YES

2.20	If the new structure lies close to another airspace structure or overlaps an associated airspace structure, have appropriate operating arrangements been agreed?	PARTIALLY
	Draft LOAs have been developed and agreed to consider the interactions with the Controlled Airspace and MATZ/ATZ for and RAF Fairford. These LOAs will need to be signed off before the IAPs are implemented. The northerly leg of the IAP to access to the current Brize CTR. Subsequent approval of the Brize ACP would also place the southern leg of the IAP to RV Airspace but would otherwise no impact on the arrangements already contained in the LOA.	RW26 requires
2.21	Where terminal and en-route structures adjoin, is the effective integration of departure and arrival routes achieved?	N/A
3.	Supporting resources and communications, navigation and surveillance (CNS) infrastructure	Status
<b>3.</b>	Is the evidence of supporting CNS infrastructure together with availability and contingency procedures complete and	<b>Status</b> YES
	Is the evidence of supporting CNS infrastructure together with availability and contingency procedures complete and	

	<ul> <li>Navigation: Is there sufficient accurate navigational guidance based on in-line VOR or NDB or by approved RNAV-derived sources, to contain the aircraft within the route to the published RNP value in accordance with ICAO/Eurocontrol standards? For example, for navaids, has coverage assessment been made, such as a DEMETER report, and if so, is it satisfactory?</li> </ul>	YES
	The Sponsor's APDO has had a monitoring station in place for 16 months in order to assess the suitability of the Signal in demonstrated a 98.8% performance level. If there was an issue with the SiS, use of the IAPs would be suspended. The Sp confirmation of acceptance on the EGNOS Working Agreement. There is a risk due to Brexit that the UK may no longer b participate in EGNOS; should Kemble not have access to EGNOS on implementation of the IAPs the LPV minima would not withdrawn from use.	oonsor is waiting for e permitted to
	Surveillance: Radar provision – have radar diagrams been provided, and do they show that the ATS route/airspace structure can be supported?	NO
	Kemble does not utilise surveillance data. RAF Brize Norton provides some surveillance-based ATC services (LARS and CTR crossing) and will continue to do so under the revised LOA. UK FIS and air traffic services provided by Brize will be in accordance with existing surveillance capabilities.	
3.2	Where appropriate, are there any indications of the resources to be applied, or a commitment to provide them, in line with current forecast traffic growth acceptable?	N/A
	No changes to resources.	

4.	Maps/charts/diagrams	Status
4.1	Is a diagram of the proposed airspace included in the proposal, clearly showing the dimensions and WGS84 co-ordinates?	YES
	(We would expect sponsors to include clear maps and diagrams of the proposed airspace structure(s) – they do not have to accord with aeronautical cartographical standards (see airspace change guidance), rather they should be clear and unambiguous and reflect precisely the narrative descriptions of the proposals.)	
	There are diagrams in the main submission and draft AIP amendments, with WGS84 coordinates in the APDO informat draft AIP amendments.	ion document and
4.2	Do the charts clearly indicate the proposed airspace change?	YES
4.3	Has the change sponsor identified AIP pages affected by the change proposal and provided a draft amendment?	YES
	amenument:	
4.4	Has the change sponsor completed the WGS84 spreadsheet and submitted to the CAA for approval?	YES
	The only requirement for a WGS84 aerodata spreadsheet is to provide 5LNCs for the IAFs (x4), which is underway. All other data will be provided by the APDO as part of the data pack for implementation. 11 Dec 2020: IFP review complete.	

5.	Operational impact	Status
5.1	Is the change sponsor's analysis of the impact of the change on all airspace users, airfields and traffic levels, and evidence of mitigation of the effects of the change on any of these, complete and satisfactory?	YES
	Consideration should be given to:	
	a) Impact on IFR General Aviation traffic, on Operational air traffic or on VFR General Aviation traffic flow in or through the area.	YES
	The proposal has evolved to take account of local traffic in Class G airspace, including local gliding sites, and the Sponso draft LOAs in discussion with RAF Brize Norton to take account of Brize Norton and Fairford IFR and VFR traffic. Discussion held with the nearest airports (Bristol and Gloucester). The impact is expected to be negligible when considering the an of approx. 250 approaches per year (maximum of 5 in any single day but more likely to be 1), and that this activity is alrewithout the benefit of IAPs.	ons have also been ticipated low usage
	b) Impact on VFR Routes.	N/A
	There are no defined VFR Routes in the area.	
	c) Consequential effects on procedures and capacity, i.e. on SIDs, STARs, holds. Details of existing or planned routes and holds.	PARTIALLY
	The proposal includes revised procedures that introduce slot times for use of the IAPs. Aircraft (IFR and VFR) will be prevented from the off and the visual circuit will be closed once the IAP is in use. Traffic information will be provided to all other aircraft receiving a service the unit in order to mitigate the risk of MAC. The Sponsor has provided additional information on the options available in the event mitigate that takes into account the slot system and lack of holds.	

	d) Impact on airfields and other specific activities within or adjacent to the proposed airspace.	YES
	The Sponsor has conducted effective engagement with local minor airfields and gliding sites in order to consider the the proposal and to develop suitable LOAs. The draft LOA with Brize and the Pilot Brief consider the need for access northern leg of the IAP to RW26; it is considered that this service will also apply to the southern leg should the Brize Although Brize will not be providing an Approach Control Service for Kemble, the current and draft LOA describe the outside the CTR. The Pilot Brief describes the impact of the activation of Fairford and the additional need to request	to the CTR for the ACP be approved. provision of LARS whe
	e) Any flight planning restrictions and/ or route requirements.	NO
	There are no changes to flight planning or route requirements as a result of this proposal.	
5.2	Does the change sponsor consultation material reflect the likely operational impact of the change?	YES
	The IAPs replicate activity that is already taking place, so the impact of their implementation is expected to be minor the Sponsor and operators of in-scope aircraft; other airspace users will have more accurate information about the provision of traffic information on request.	

# Case study conclusions – to be completed by SARG project leader

Yes/No

Has the change sponsor met the SARG airspace change proposal requirements and airspace regulatory requirements above?

PARTIALLY

When considering the operational aspects of this proposal, the Sponsor has met the requirements of CAP1616 and other relevant regulatory requirements (subject to IFP review). On balance, the proposal has been developed through an appropriate and proportionate approach given the likely low impact of the change. There is a clear business need for the introduction of IAPs and the impact on Kemble's own traffic and that of the local area has been considered, with feedback taken into account when refining the procedures.

Discussion have been held with the Sponsor regarding the closure, limiting access to or restricting the ATZ. The Sponsor understands and accepts their limitations in this respect, and some inappropriate references to restricting the ATZ have been eradicated. However, within V2 of the final proposal some references remain. The proposal includes appropriate adjustments to the AFIS operation, and notwithstanding the need for a dispensation to Article 183, they are in keeping with the provisions of the AFIS licence. The remaining references to 'closing' or 'restricting' the ATZ will need to be removed from AIP amendments and other documents that describe the operation, such as the Pilot Brief and ATS procedures, prior to implementation of the IAPs.

Within the Final Options Appraisal Assessment there is reference to an inconsistent reporting in the cost benefit analysis with respect to the impact on net airspace users benefit versus net community benefit, which differs from the Initial Options Appraisal. However, the CAA has determined that this does not materially affect the outcome of this ACP or the option selected in the final proposal because:

- The number of in-scope aircraft is extremely low.
- The in-scope flights already take place under the current operation.
- Other than the 'do nothing' option, there is nothing to differentiate the economic impact across the options considered.
- Broader work by the DfT and the CAA looking at 'GNSS IAPs without an Approach Control Service' has concluded that qualitative statements on the economic impact of a proposal are acceptable.

Whilst there was an issue in V2 of the submission regarding the justification for the lack of holds, the Sponsor has provided a supplementary document at the request of CAA (AR) that gives reasonable and sound justification for not implementing holds, which supports the overall safety arguments for the introduction of the IAPs.

Outstanding IFP technical design comments on the draft IAPs need to be addressed – these include obtaining 5LNC and an EGNOS channel number, as well as completion of validation activities (the outcome of the latter may impact on the design of the procedure). This is activity ongoing between CAA Airspace Regulators (IFP) and Kemble's APDO.

Having considered the Sponsor's supplementary document regarding the change in design for the missed approach procedure for Runway 26, the CAA agreed that the impact was negligible given the likely very low frequency of use and that the extended leg mirrored the track flown for approaches to Runway 08. The CAA determined that there were potential benefits from the change due to removing overflight of Tetbury and further reducing the risk of inadvertent entry into the Highgrove House Restricted Area (EG R106). The Sponsor was informed that there was no need for further consultation but all stakeholders should be notified of the minor modification to the design since consultation as this had not specifically been highlighted in the final submission documents.

11 Dec 2020: IFP review complete.

### **RECOMMENDATIONS/CONDITIONS/PIR DATA REQUIREMENTS**

Are there any Recommendations which the change sponsor should try to address either before or after implementation (if approved)? If yes, please list them below.

NO

**GUIDANCE NOTE:** Recommendations are something that the change sponsor <u>should try</u> to address either before or after implementation, if indeed the airspace change proposal is approved. They may relate to an area in which the change sponsor is reliant upon a third party to actually come to an agreement and consequently they do not carry the same 'weight' as a Condition.

Are there any Condition(s) which the change sponsor <u>must fulfil</u> either before or after implementation (if approved)? If yes, please list them below.

YES

**GUIDANCE NOTE:** Conditions are something that the change sponsor <u>must fulfil</u> either before or after implementation, if indeed the airspace change proposal is approved. If their proposal is approved, change sponsors <u>must observe</u> any condition(s) contained within the regulatory decision; failure to do so <u>will usually</u> result in the approval being revoked. Conditions should specify the consequence of failing to meet that condition, whether that be revoking the ACP or some alternative.

All draft LOAs need to be finalised and signed prior to implementation (normal practice).

Any remaining terms relating to the 'closure' of ATZ need to be removed from AIP documents, LOAs, operational procedures, safety arguments and guides.

Are there any specific requirements in terms of the data to be collected by the change sponsor for the Post Implementation Review (if approved)? If yes, please list them below.

<u>GUIDANCE NOTE:</u> PIR data requirements concerns any specific data which the change sponsor <u>must</u> collate post-implementation, if indeed the airspace change proposal is approved. Please use this section to list any such requirements so that they can be captured in the regulatory decision accordingly.

The following specific sections of CAP1616 Table H1 should apply to this ACP for PIR data collection:

Safety data.

Service provision/resource issues.

Traffic figures.

Operational feedback.

Denied access statistics. NOTE: This should account for denial of access to the IAPs as well as entry to the ATZ.

Utilisation of SIDs/STARs/instrument flight procedures. NOTE: To include as far as reasonably practical use of MAP and any inability to maintain compliance with the published IAP.

Letters of Agreement.

Impact on environmental factors. NOTE: To be based upon any observed or reported matters.

Impact on Ministry of Defence operations.

Stakeholder feedback. NOTE: To include comments/complaints relating to the use or impact of the IAPs. Examples of sources include MORs, DASORs, routine and ad-hoc meetings, emails, social media. Provided in machine readable format wherever possible.

# **General summary**

The Sponsor has met the requirements of CAP1616. The Kemble IAPs are intended to support flights that already take place, and any changes to flight behaviours are unlikely to be noticeable by other airspace users or parties on the ground, especially for the last 8nm of the approaches. The justification for not including holds in the IAPs is supported by the assigned Technical Regulator and Inspector ATS (Operations).

## **Comments and observations**

The outcome of the ACP does not materialistically change current aircraft behaviours but provides in-scope aircrew with a defined and systemised procedure that should aid in cockpit workload and planning. The interaction with Brize controlled airspace complicates the procedures but this is already the case now; the existing LOA and draft replacement demonstrate a willingness to maintain a positive relationship that considers the needs of both parties. The proposed Kemble IAPs would provide greater clarity on the approach path and should assist Brize with integrating IFR and VFR traffic inside CAS. Should the Brize ACP be approved then the Kemble procedures are unlikely to need to change, but access to Brize CAS will be required for all approaches to Kemble's westerly runway; this is understood by Kemble and Brize.

Operational assessment sign- off/ approvals	Name	Signature	Date
Operational assessment completed by:	AR Technical Regulator		21 Oct 2020
Operational assessment approved by:	Manager Airspace Regulation		23 Oct 2020

Manager Airspace Regulation comments: This airspace change proposal has been conducted in accordance with the CAP1616 Airspace Change Process (ACP); before the scaled CAP1961 application of the ACP became available. I agree that the two open observations in the Options Appraisal do not have a material impact. The ATZ points raised by the Airspace Regulator (Technical) regarding the purpose of an ATZ are correct – it takes on the background classification (in this case Class G) and is there to provide a better-known traffic environment to all in the vicinity of the visual circuit. Whilst there are Rule 11 access requirements, it is not a structure that can be 'closed' to users. I agree with Kemble's assertion that a Hold associated with the IAPs is not an operational necessity, but don't agree it is less safe to have one – I think either option can be argued as safe. Notwithstanding that, and having read all CAA SME's opinions on this matter (in particular the Airspace Regulator (Technical) and Airspace Regulator (IFP)), I am content that no hold is required.

Head AAA approval/decision	Name	Signature	Date
Operational assessment conclusions approved by:	Head AAA		28 Oct 2020

Head AAA Comments: This proposal follows CAP 1616 well and a thorough argument has been made and accepted for the procedures. The AAA management team met (27/10/20) to discuss the logic and safety case put forward by the sponsor of the proposed absence of a hold for either procedure. We are content that the mitigations in place for traffic separation adequately achieve an acceptable level of safety that is not materially different from current missed approach operations. Taking the procedures as a whole, the safety of large aircraft operations at Kemble will be enhanced by implementation of these procedures. This proposal is approved subject to the flyability of the procedures being proven before submitting to an AIRAC cycle.