Electronic Tracing of Livestock

Project Outline

Industry led EID research Phase 4
2013 - 2014

**Proposals to the Joint Scottish Government
Industry Working Group on EID & EDT**

Prepared by:

SAOS Ltd
Rural Centre
Ingliston
EH28 8NZ

0131 472 4100
www.saos.co.uk

26th June 2013

Contents

Electronic Tracing of Livestock
Project Outline

Background

1.   The Scottish Agricultural Organisation Society (SAOS) acts, on behalf of the joint Scottish Government/ Industry Working Group, as project co-ordinator for research into the feasibility of electronic identification (EID) and Electronic Data Transfer (EDT) for livestock.   The overall aim is to utilise applied research and development to meet the need for more accurate and faster tracing of animals through their various supply chains in a manner that meets regulatory requirements and is understood and accepted by industry.

2.   Motivation for the research stems largely from the implementation of existing European Union (EU) requirements for EID in sheep and goats plus EU discussions on EID being introduced for cattle and exploration of the available technologies. For sheep and goats the technology prescribed by the EU was Low Frequency (LF).   For cattle no decision has yet been taken by the Commission on the prescribed technology although there is a strong push by other Member States for it to be LF and allow for harmonisation across the EU.   Scottish Government, whilst remaining technology neutral, appreciate that there may be other technologies which could be more suitable and Ultra High Frequency (UHF) is being considered as an option.

3.   As the Scottish cattle industry have indicated a desire to move to bovine EID, the research is designed to involve a large number of livestock under commercial rather than experimental situations. This permits greater practical involvement of industry stakeholders but also "learning by doing" in testing, monitoring and adjusting equipment and practices under working conditions at farms, marts and abattoirs. For example, with respect to the choice of tags/transponders and electronic readers or the configuration of readers and software to communicate with the ScotEID database system whilst minimising disruption to existing on-site management regimes.

4.   Drawing on various sources of expertise, the research is organised through ScotEID which acts as point of contact (via an Information Centre at Huntly plus a website) for industry participants plus as holder of electronic movement data held in the ScotEID database system. The ScotEID system is written using open source software within industry-leading database and software frameworks, and is capable of accommodating multiple species and differences between, for example, broadband and dial-up users, different types of computer running various vintages of different operating systems and web browsers.

5.   To-date, three research Phases have been completed. Phase 1 (2008 to 2009) focused primarily on the practicalities of identifying and configuring appropriate LF hardware for sheep (i.e. tags and readers) and software to permit reliable movement recording and reporting to the ScotEID database

system. Over 200 partner farms were involved in this Phase, together with six marts and three abattoirs. Considerable on-site technical efforts led to the successful development of solutions to suit a range of circumstances (e.g. local conditions, existing software). At the same time, the ScotEID database structure capable of meeting existing and anticipated regulatory requirements was designed and created. Almost 40k sheep movements were recorded with a read-rate of 96%.[1]

6. Phase 2 (2009 to 2011) extended enrolment to over 3500 farms, 30 marts and 20 abattoirs, plus two ferry terminals and two collection centres. Experience gained during Phase I was applied to guide wide-spread adoption at the farm-level, plus on-site support was offered to new mart and abattoir partners. Extending farm enrolment greatly increased the number of EID sheep, leading to a significant increase in the volume of movements reported electronically to the ScotEID database system: over 2m movements were recorded, with an overall read-rate of 94%.[2]

7. Phase 3 (2011 – 2013) effectively extended coverage to the entire sheep sector, with over 12m movements now held on the ScotEID database system. Further refinements were made to technical and procedural aspects of recording and reporting sheep movements, but scope of the research was also widened to include other species. Specifically, pig movements (2m) were added to the system as was a disease component for combining data from various sources (e.g. lab test, CTS) to support control of Bovine Viral Diarrhoea (BVD) in the Scottish cattle herd. In addition, limited testing of UHF technology and dual LF/UHF for cattle EID was undertaken.

Objectives

8. To reflect the evolving nature of EID and anticipated EU bovine EID regulations, objectives agreed previously with the joint Scottish Government and Industry Group for earlier Phases may be amended slightly. Hence:

   The overall objective is to utilise applied research and development to explore the feasibility of a Scottish multi-species livestock relational database system capable of interfacing with other data systems to meet regulatory requirements for the UK Member States well as taking on board additional industry requirements.

9. Similarly, the amended supporting objectives are:

   a) To allow all sheep and goat movements to be reported either electronically or by paper to ScotEID, with continuing attention to practical and cost issues encountered across a stratified national flock and extensive production systems in remote areas.

---

[1] Further details are available in the Phase I report available from SAOS.

[2] Further details are available in the Phase II report at:
http://www.scoteid.com/Public/Documents/EID_Pilot_Phase_2_report.pdf

b) To enable livestock keepers to view and amend their movement and register data via ScotEID, with a view to reducing paper-based administrative burdens and cross-compliance liabilities.

c) To enable the ScotEID database system to play a key role in the eradication of BVD.

d) To allow Scotland to consider the feasibility of an electronic cattle movement system taking into account the outcomes of EU proposals for bovine EID.

e) To carry out field trials to research EID technologies for cattle on farms, at marts and in abattoirs.

f) To investigate (with specialist support from BIOSS/EPIC) how data held in a multi-species database system is able to improve traceability/cohort connections between species and how links to other data systems may aid disease control (e.g. for BVD).

g) To investigate how the technology and data systems may be used to help support other requirements across the food chain e.g. FSA derived carcass health data, and information which may impact meat eating quality and more efficient production.

10. The first three research Phases provide a sound basis for pursuing these amended objectives. However, achieving requires system research and development beyond simply continued refinement of existing elements. In particular, further development of the sheep movement system to include electronic reporting of all movements and continued exploration of the potential for a multi-species livestock movement system are the objectives for phase 4, subject to maintaining the stability and robustness of the system as the volume and types of movements reported increase.

11. The remit of Phase 3 was expanded somewhat during its duration, most notably by the urgent requirements to add the BVD and pig components, which were significant software developments to the database, plus activities such as providing academic data for EPIC. Consequently, further funding has been secured to complete some of the tasks added to Phase 3 plus some originally envisaged tasks that were displaced by new ones (e.g. initial development of BVD data recording systems displaced work to replace the sheep movement documents).

12. In addition, the evolving policy context and emergent findings from Phase 3 have generated further research questions for data exchange and the exploration, development of protocols and agreements with other data systems that will also need funding beyond that needed to complete the expanded Phase 3. With some degree of overlap, the remaining Phase 3 tasks plus new Phase 4 tasks are described in the next Sections.

Activities

Extension of paperless notification to all sheep movements.

13. Currently, farm-to-farm moves, moves are recorded and sent on paper to SAMU. (Moves to markets and abattoirs are recorded on paper but reported to SAMU by e-mail) This weakens the traceability system by introducing possible manual errors and a delay in capturing movement data.

14. Further development work will allow all sheep and goat movements to be recorded either electronically or by paper onto the ScotEID database system, to ensure comprehensive coverage. The work will require clarification of the relationship between SAMU and ScotEID and promotion of the existing options for notifying ScotEID. That is, various technical systems have already been or are in development e.g. manual interaction with the website, smartphone apps and telephone notification to the Huntly office. Of relevance are various procedures and software developed for the movement notification of pigs. Livestock keepers will be able to view and amend their movement data via ScotEID.

15. Greater uptake of electronic notification of farm-to-farm moves will require some further technical and systems development for transport notification e.g. the form of transport identification: note 21/2004 derogation Article 6(4) and Annex C1(e). The value of this, and of on-line farm registers, will be explored in the context of available derogations.

16. Importantly, moving keepers to electronic notification may require promotion of the benefits of doing so – most notably the avoidance of paperwork in the form of movement documents and paper based flock registers (see 21/2004 derogation Article 5(4) and Annex B). That is, traceability may benefit from data being as fresh and a clean as possible but farmers may require some other, more immediate incentives to provide this – perhaps avoiding possible future cross-compliance requirements or highlighting "black loss" problems.

On-going monitoring of LF performance

17. Although a very large proportion of sheep batches achieve high read rates (73% of batches have a read rate of 100%), overall performance is marred by the persistence of lower read rates for some batches. Also, data confirm a lowering of read rates correlated with increasing age of tags. Continued incremental improvement will be aided by a better understanding of the reasons for such lower read rates. The European Commission has expressed an interest in such insights, which will also inform domestic debates on policy and cross-compliance issues.

18. Identifying the reasons for poor read rates will require physical inspection of a sample of batches with low read rates to check for possible causes such as lost tags or malfunctioning tags. Achieving this will entail site visits, ideally immediately after poor read rates have been detected. Equally, sample observation of routine practices at CCPs and/or farms may provide insights

into the contribution of procedural/handling errors or other confounding factors to poor rates and how these problems may be resolved.

19. Separately, it is also proposed to use the database to identify departure keepers with regular instances of low read rates to then contact them to offer independent advice on best practice.

Completion of BVD component

20. The advent of the ambitious industry led Scottish BVD eradication programme and required a BVD component to be developed in the ScotEID database system. This was belatedly added to the remit of Phase 3 and entailed considerable development effort, particularly with regard to normalisation and requirements for contemporaneous data, but demonstrated that construction of the ScotEID system was not an impediment to progressing policy objectives.

21. However, further work is needed to meet all of the requirements in a robust manner to enable the system to play a key role in the eradication of BVD. For example, there is scope to improve the speed of laboratory test result updates and data validation procedures require further consideration. The latter point reinforces the need for access to cattle movement data in resolving known identification problems with animal health records requires data from a verifiable source of animal and location identifiers currently obtained from CTS. Access to cattle movement data highlights the research and links required to look at the potential for a multi species livestock database system for Scotland.

22. The BVD workstream is industry-led under the Animal Health & Welfare Strategy and demonstrates the value of open sharing of disease information to support policy delivery. For example, voluntary declarations and automatic data feeds from laboratories and CTS allow rapid detection of issues in a transparent manner. It is already possible to monitor persistently infected animals and the experience gained with BVD may serve as a model for other diseases. However, issues remain regarding who has responsibility for reporting detected problems and enforcing health protection policy.

23. Work is on-going by the Huntly office to develop procedures (to ISO 9001:2008) and support information to assist farmers with interpreting their BVD data, which will become available on-line in due course.

Researching feasibility of extending EID to cattle, based on EU Bovine EID proposals

24. The core structure of a multi-species movement database was previously created but there is a Scottish Industry wish that should be extended beyond the existing BVD element for cattle in the Scottish herd. This would be in anticipation of likely EU regulatory requirements for EID in cattle. Any change to cattle movement reporting systems would necessarily require a transition plan and would inevitably entail detailed discussions and planning.

25. Investigation of the feasibility of ScotEID facilitating EID implementation across the cattle population would encompass consideration of the robustness and accuracy of data, but also compatibility with existing databases[3] and data management processes. Indeed, rather than undertaking data analysis (other than movement tracing), ScotEID primarily offers a convenient means of managing data transfers to other databases whilst (unlike some other arrangements) retaining industry ownership of the data.

26. Given the different types of data within a multi-species database system and different uses to which they may be put, dialogue with stakeholders would be necessary to distinguish between them and to agree legitimate uses of different data. For instance, for statutory reporting, for enforcement, for academic research and for commercial purposes. As an example, BVD links to QMS interests and to FSA (post-slaughter) interests.

27. Drawing on the experience of constructing the BVD element during Phase 3, the main building blocks include:

   a) Adapting the core database to accommodate cattle information, movements and statutory requirements, once EU proposals are finalised and technical standards have been agreed

   b) Investigating the development of web services to interface with various government systems.

   c) Developing web services for interface with proprietary farm management software.

   d) Further development of the Java application, which is the universal interface to every type of reader (Providing for LF, UHF, bar code, 2d bar code, manual reading simultaneously).

Field trials to research EID technologies for cattle

28. The use of paper passports for cattle movements is an acknowledged cost on the industry. Hence there is considerable interest in whether the anticipated amending Regulation (EC) No 1760/2000 as regards electronic identification of bovine animals can be used to reduce administrative costs as well as improving traceability. Discussions on bovine EID proposals in Europe have stalled because of proposed amendments to the main Regulation which the European Parliament wanted included on cloned animals. When discussions get back on track it will only be after the Regulatory changes are agreed that the Commission will look at the technical standards. The Commission had agreed, following sheep EID, to better engage industry and discussions on the standards will be through an EU technical working group which Scottish

---

[3] For example, ScotEID can handle multiple keepers on a single holding, but CTS cannot. As CTS continues to remain the single Member State database any dataflow to it has to be in such a form and manner that can be easily uploaded to CTS without incurring costly upgrades to the CTS.

industry are represented. However, harmonisation for trade is driving this forward at EU level and the EU has already stressed that it needs the technical standards for cattle to be consistent across all Member States.

29. Documented results for both LF and UHF cattle applications, both within and outwith Scotland provide some guidance on relative strengths and weaknesses of the two technologies. Equally, prior experience of LF applications for sheep over Phases 1, 2 & 3 and limited testing of UHF equipment during Phase 3 provide first-hand insights into likely performance including Scottish Government commissioned Research from SRUC into the potential of UHF to replace cattle passports.

30. Nevertheless, as with sheep EID, performance under commercial conditions needs to be investigated and tested. In particular, although handling speeds for cattle are generally slower than for sheep, reliability of reads is crucially important and it is necessary to demonstrate the accuracy, robustness and reliability of transponders. Also, other practical considerations such as working at the speed of commerce, cost benefits, H&S aspects and numbering systems need to be considered.

31. This will entail significant technical effort, including hardware configuration, software development and identification of appropriate handling procedures to suit a variety of local circumstances on farms, at marts and in abattoirs. As with sheep, statistically robust analysis will require a relatively high volume of movement data, implying a need for a significant number of cattle to be involved in the research.

32. To reduce the overall number of individual cattle and individual tags required, it is proposed to use dual LF-UHF tags for the research. These were developed during Phase 3 in conjunction with tag and transponder manufacturers as a technical hedge against the EU eventually favouring one or other of the technologies. Yet they also offer a convenient means of avoiding the need for either multiple tags per animal or different tags for different animals. Moreover, they also facilitate comparative evaluations under identical conditions i.e. the same animal at the same location at the same time.

33. In addition to the dual LF-UHF transponder internally, it is also proposed to have tags marked externally with both the full 14 character ID and its barcode representation, meaning that the ("4-in-1") tags will offer four ways of reading an ID i.e. visually, with a barcode scanner, with an LF reader and with an UHF reader. [4]

---

[4] It is important to note here that unless the EU was to explicitly prohibit the use of UHF technology, UHF would remain an option for the reading of tags even if the EU regulated for LF. That is, it is difficult to envisage the regulations relevant to reading a tag (as opposed to a bolus or an injectable chip) as being amended to exclude alternatives such as manual transcription, barcode-scanning or (by extension) UHF technology – currently, tags bearing a printed number and barcode could include no transponder or an LF transponder and/or a UHF transponder (although ISO compliance is an issue). Currently the primary tag can contain a barcode but no transponder. The secondary tag may contain a transponder and although not officially approved at this time it could be used for management purposes.

34.   Possibilities for constructing the tags as true WYSIWYG[5] will be also explored, not least to ease database reconciliation between reported LF and UHF reads. Given the absence of EU bovine EID regulations, any EID tags cannot yet be used as official tags nor allowed to be incorporated in the primary cattle tag and will thus have to be treated as management tags. They can however, be incorporated in the secondary tag as such. This may dissuade some keepers from participating in the research.

Farm-level trials

35.   High volumes of read data can be generated most rapidly by trialling EID in dairy cattle. That is, twice or thrice-daily milking of large herds will provide convenient opportunities for testing accuracy and reliability. For example, enrolling ten large dairy farms with 5k cattle would generate perhaps 12k reads per day. In due course, some calves and cast cows from partner farms would also appear at marts and abattoirs to give further readings.

36.   Although dairy farms offer opportunities for rapid data generation, other cattle farming systems need to be considered. Specifically, it is proposed to also enrol a small number (perhaps 15) of suckler herds with around 5k calves and older cattle. Again, some tagged calves and cows would appear at marts and abattoirs in due course, but relatively few movements would be recorded per se. Instead, enrolment will be conditional on EID being used actively for management purposes (e.g. profiling individual animals, recording growth rates and veterinary treatments) to ensure a reasonable number of opportunities for reading tags.

37.   For both dairy and suckler herds, farms would be issued with the required number of 4-in-1 tags plus LF and UHF readers. On-site support would be offered to facilitate hardware installation and procedures for reading and reporting movements, plus utilising data for management purposes. In some cases, partner farms (more likely dairy ones) may already use LF management systems. If so, there may be scope for additional testing of legacy systems' compatibility with dual-tags and/or for modest cost savings by using UHF tags only.

Mart and abattoir trials – Industry led initiative

38.   The volume of cattle movements through marts highlights the administrative costs (estimated at £2/head) of handling paper passports and points to the potential for EID to streamline processes. However, generating reasonable volumes of read data from a mart requires either the repeated passage of the same few EID cattle through the ring and/or the normal (commercial) passage of higher numbers of EID cattle. Both approaches would be capable of acting

---

[5] This is more of a challenge for LF than UHF, and would mean that tags and readers would not comply with ISO11784 & ISO11785. However, given stakeholder preferences, the feasibility of achieving WYSIWYG merits consideration and would not distract from comparative evaluation of underlying tag and reader performance.

as live demonstrations on auction days, to allow the farming community to see first-hand how the technology performs.

39.   Using a few EID cattle, but using them repeatedly, would avoid the need to issue large numbers of tags meaning that enrolment would be easier and less costly. Commercial performance under commercial conditions could still be evaluated since handling could be on auction days alongside non-EID lots. Alternatively, and probably less disruptively, performance could be evaluated on non-auction days when repeated passes through the ring to test different configuration might be easier.

40.   By contrast, if a reasonable proportion of cattle passing through the ring on a commercial basis were EID tagged,[6] this would generate opportunities for tag reading under less artificial conditions. However, this approach would necessarily incur higher costs through tagging a greater number of animals (perhaps 30k) and would require greater co-ordination to identify and enrol more farms in advance[7]. The marts themselves could play a key role here, including perhaps through sharing the costs. Marts would be provided with UHF and LF readers (the latter may need to be prototype hoop readers) plus on-site assistance with installation and the design of handling procedures compatible with existing management systems. Co-ordination with marts and promotion of trials as an "industry-led initiative" with a degree of cost-sharing would be required to drive this forward. SG is happy to support this providing assistance through the ScotEID project.

41.   For abattoirs, given that possibilities for repeated passage of the same animals are effectively non-existent, generating read data depends on the number of EID cattle passing through on a commercial basis. In turn, this rests again on enrolling and tagging a reasonable number of animals. Achieving this (for perhaps 10k of cattle) will require a degree of prior communication with known suppliers to identify cattle intended for slaughter in the near future.   Abattoirs would be provided with UHF and LF readers plus on-site assistance with installation and the design of handling procedures compatible with existing management systems.

Future development and data sharing arrangements.

42.   As a relational, multi-species animal movement database system, ScotEID has many desirable operational characteristics including, substantially, the rapid nature of the data provision and refinement by industry users. Moreover, it provides various data management possibilities.

43.   However, ScotEID does not operate in isolation and there is a need to establish routine data sharing to and from various other animal databases, both in Scotland and in the wider UK. For example, eAML2, BCMS, ETAS, AHVLA & RADAR via LMED[8], FSA, SG IT Futures programme and eventually the proposed sheep databases in Wales and England.

---

[6] And were easily spotted due to e.g. a distinctive tag colour.

[7] It is desirable to avoid simply tagging animals immediately before they enter the ring.

[8] Livestock Movement Extract Database

44. The challenge of achieving this should not be under-estimated and will require attention to technical and procedural aspects (e.g. how and when data are passed to ScotEID and input). In particular, various protocols for data sharing, control, processing and data protection will need to be agreed to the satisfaction of all parties.

45. The distinction and mix of core regulatory and any other industry data will need to be maintained, as will the distinction between data management functions (within ScotEID's remit) and separate analytical functions (out with the remit). Data sharing agreements need to be in place to clarify mutual understanding amongst all stakeholders of the status of the database, its purpose and permitted usage of the data. In particular, it is important to distinguish between ownership of the data and access to it for legitimate purposes.

46. As currently configured, the data is owned by the industry and the Scottish Government owns the database structure and has access to the data in order to meet full EU regulatory requirements for livestock identification and traceability (DG Sanco) and cross compliance (DG Agri)and undertake livestock tracings. This model appears to be working in that, since the data may be used for inspection purposes, farmers have an incentive to check, update and correct any errors in their own data – and have the ability to do so at no cost since they own it and have ready access to it. As such, industry trust in (and thus co-operation with) the system is arguably higher than it might be under alternative models. For example, the use of commercial intermediaries could impose higher costs on both farmers and government whilst government ownership could undermine transparency and trust.

Database queries

47. Creation of a relational multi-species movement database is a notable achievement, reflecting commendable foresight by the joint Scottish Government/ industry working group. However, beyond demonstrating the ease with which database queries can be developed and relevant data can be extracted, relatively little consideration has yet been given to how best to arrange and maintain specified database queries to service enforcement authorities and other stakeholders' specific needs.

48. For example, if a disease outbreak were to occur, what precise questions would need to be asked and how should resulting information be presented? Equally, out with an outbreak, how could the database be used to inform a proportionate, risk-based inspection regime or to improve industry statistics? Specialist advice from, for example, BIOSS/EPIC may be helpful in this regard.

49. Addressing such issues need not necessarily entail significant technical developments, but it will require liaison between ScotEID, government, industry and analysts (e.g. EPIC) to discuss data needs, improve users' understanding of database capabilities, agree appropriate analytical and visualisation tools and to agree data sharing protocols. Sheep scab might

serve as a convenient first empirical example to motivate such developments, as might tracing of BVD Persistent Infections.

50. Separately, it is apparent that awareness amongst the industry – and indeed parts of Government – of the capabilities of ScotEID is less than it might be. Consequently there is scope to more proactively promote ScotEID in terms of its functionality and potential value to a range of stakeholders.

Method, research outputs & reporting

51. Phase 4 will essentially utilise the same methodological approach deployed in previous Phases of the research.

52. In particular, the research is designed to involve a large number of livestock under commercial rather than experimental situations. This permits greater practical involvement of stakeholders but also an element of "learning by doing". This is applied at both the level of the individual farm/mart/abattoir in terms of EID, reading and transmitting data, but also in terms of resolving technical and procedural issues relating to the design of the Central Database and the transfer of information to and from it.

53. Additionally, by proactively involving industry in the research, the proposal seeks to further develop a positive attitude to EID and EDT by demonstrating the advantages of electronic recording. That is, a database system with EID recording should be a cost-effective approach to automating movement recording and to improving the integrity and speed of movement recording. For cattle it will take into account that near perfect read rates at the speed of commerce are necessary at the outset.

54. Overall, the proposed work in Phase 4 will result in research and development that engages the industry in finding appropriate and cost-effective solutions and populates a relational livestock database system with statistically relevant information to inform the Scottish Government and industry.

55. The joint Scottish Government/industry working group will provide guidance for the duration of the project. It will be necessary to meet and update the group or individuals of the group at intervals throughout the research.

56. Formal reports on specific topics will be provided on request, and the ScotEID system (being based on open source software and an object-oriented approach with in-line comments) can be viewed at any time to inspect its structure and performance.

57. This proposal has been designed to deliver credible research that will produce as accurate as possible data on the movement of livestock across farms, marts and abattoirs in Scotland. To this end the proposal aims to involve the Scottish livestock industry under conditions that are as 'true to life' as possible. Given on-going technological developments and on-going EU

discussions, the proposal is therefore subject to change and should be regarded as work in progress.

Management & co-ordination

58. SAOS will co-ordinate the research on behalf of AFRC. Various procedures have been put in place by SAOS to properly deal with funds and sub-contract the required expertise to deliver various work streams.

a) The monies for the research will be ring fenced and expenditure is accounted for on an on-going monthly basis with records made available immediately on request. SAOS Finance Manager, Graeme Johnston, will be in overall charge of accounting.

b) SAOS's standing remit from AFRC concerns the development of the industry through supply chains, co-operation and its stakeholders. This is consistent with research for the rollout of EID throughout the industry.

c) The legal liability for the research will rest with SAOS, who have informed their insurers. The primary liability for SAOS will be for the provision of wrongful advice. As a legally separate entity, ScotEID has liability for the accuracy of movement reporting.

d) SAOS's main function is to manage the research and will liaise with AFRC and the industry group throughout. This working plan will be updated as required.

e) The office at Huntly will be maintained to gather research evidence from the practical operation of the systems and provide support and guidance where required. The office will liaise closely with CCP's, BVD laboratories, keepers etc. to ensure that data systems and procedures build robustness and increase accuracy.

f) SAOS will sub contract Black Isle Technical Services and Jon Bjerland for the build of the database, data transfer, run time testing and monitoring of data flows.

g) SAOS will sub contract Pareto Consulting (Dr Andrew Moxey) to provide various analysis and reporting of cattle EID. (Final detail to be agreed with AFRC.)

h) SAOS will sub contract BioSS to provide data for analysis and statistics, with provision to EPIC also possible (Final detail to be agreed with AFRC.).

Organisation – diagram

59. Bob Yuill will manage the overall co-ordination by SAOS; he has the relevant experience and will maintain consistency with the coordination role he has provided for SG concerning the testing and evaluation of EID thus far.

60. The diagram below illustrates the structure of the project team and its relationships to each other that will deliver the research. The team draws together a wealth of expertise and experience of the livestock industry, EID, data systems, cost benefit analysis and statistical interrogation.