INTERIM REPORT

of the

Commission on Electronic Voting

on the

Secrecy, Accuracy and Testing of the Chosen Electronic Voting System

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TUARASCÁIL EATRAMHACH

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gCoimisiún um Vótáil Leictreonach

maidir le

Rúndacht, Cruinneas agus Tástáil an Chórais Vótála Leictreonaí atá Roghnaithe

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Foreword

I was greatly honoured when requested by the Government to chair a Commission to advise the Ceann Comhairle on the secrecy and the accuracy of the chosen electronic voting and counting system i.e. the Nedap/Powervote system.

I was also very pleased to have as members of the Commission, Mr. Kieran Coughlan, Clerk of the Dáil, Ms. Deirdre Lane, Clerk of the Seanad, Dr. Danny O'Hare, Chairman of the Information Society Commission and former President of Dublin City University and Mr. Brian Sweeney, Chairman of Siemens Ireland Ltd. and former Chairman of Science Foundation Ireland.
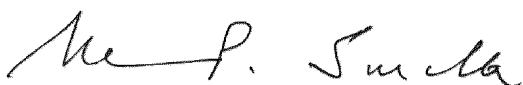
The terms of reference provided that the Commission shall make one or more reports to the Ceann Comhairle not later than 1 May 2004 comprising recommendations on the secrecy and accuracy of the chosen electronic voting and counting system, i.e. the Nedap/Powervote system, including the application or non-application as the case may be of the electronic voting and counting of the Nedap/Powervote system for the local and European elections on 11 June 2004.

The timeframe to complete the first report was, of necessity, very limited so that it was imperative for the Commission to commence its work without delay.

My thanks are due to the many people who assisted the Commission in its work to date particularly those in the University of Dublin, University College Dublin, Dublin City University, the Institute of Public Administration and my colleagues on the Commission.

My thanks are also due to the many people who went to so much trouble to furnish submissions and their views on electronic voting to the Commission.

Finally I must thank the Secretary to the Commission, Mr. Alan Murphy who impressed Commission members by his industry, energy and knowledge of the subject matter. He was ably assisted by Mr. Paul Dowling, Mr. Brendan Conroy and Ms. Anne Quinlan in his work to date.

Mr. Justice Matthew P. Smith
Chairman

29 April, 2004

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Executive Summary

Background

This is the interim report of the Commission on Electronic Voting appointed by the Government on 1 March 2004 to report by 1 May on the secrecy, accuracy and testing of the electronic voting system chosen for use at elections in Ireland.

Work of the Commission

The work of the Commission included a review of the tests already carried out on the chosen system and the carrying out of further tests on behalf of the Commission. Individual persons and organisations having expertise in the areas of political science, computer science, public administration, audit, security and statistics assisted the Commission in its work.

Public Submissions

The Commission also invited and received submissions from the public in relation to its work regarding the secrecy, accuracy and testing of the chosen system.

Conclusion

On the basis of its review of expert reports, submissions received and other relevant information to date, the Commission finds that it is not in a position to recommend with the requisite degree of confidence the use of the chosen system at elections in Ireland in June 2004.

The Commission wishes to emphasise that its conclusion is not based on any finding that the system will not work, but on the finding that it has not been proven at this time to the satisfaction of the Commission that it will work.

In addition, the Commission recognises that the threshold of proof required to support its recommendation against the use of the system is much lower than that which would be required to recommend in its favour. It is for this reason that, although its work is incomplete, the Commission is in a position to make its recommendation within the timeframe of this report.

In that connection, the Commission has not been able to satisfy itself as to the accuracy and secrecy of the system for the following main reasons:

System Testing

The tests of the system carried out to date are insufficient to establish its reliability for use at elections in Ireland in June;

Software Versions

There is not sufficient time before the June elections for a full system testing of the final version of the software that would be necessary before it could be used in these elections and the final version of the software is not available for testing at this point in time;

Source Code

The Commission did not obtain access to the full source code and there is not sufficient time before the June elections to allow a full code review of the final version of the software that would be necessary before it could be used in these elections;

Accuracy

As the software version proposed for use at the forthcoming elections is as yet unknown, it is impossible for anyone to certify its accuracy;

Secrecy

The voting machine "beeps" as preferences are being selected; publication of ballot results in full can allow voters to identify themselves in a context of corruption or intimidation; it may be possible for an insider to overcome the randomness of the method used for the storage of votes in the ballot module.

The Commission accordingly concludes that, having regard to the issues of secrecy, accuracy and testing as set out in its terms of reference, it is unable to recommend the use of the proposed system at the local and European elections and, by extension, at the referendum due to be held on 11 June.

Legal Issues

While the Commission had intended to present the full details of its work to date, it was considered prudent on the basis of legal advice received, to refrain from doing this until legislation putting the Commission on a statutory footing is in place. This report accordingly presents the conclusions of the Commission based on its work to date without presenting the details of the work itself.

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Terms of Reference and Membership of Commission

Terms of Reference

(1)   The Commission, which shall be independent in the performance of its functions, shall prepare a number of reports for presentation to the Ceann Comhairle (the Chairman of Dáil Éireann) on the secrecy and accuracy of the chosen electronic voting and counting system i.e. the Powervote/Nedap system.

(2)   The Commission shall make one or more of such reports to the Ceann Comhairle not later than 1 May, 2004 *comprising recommendations on the secrecy and accuracy including the application or non-application as the case may be of the electronic voting and counting of the Powervote/Nedap system for the local and European elections on 11 June, 2004.*

(3)   The Commission's subsequent report or reports will record its views of the operation and experience of electronic voting and counting at elections.

(4)   In carrying out its work, it will be open to the Commission to review the tests already undertaken to validate the electronic voting and counting system and to have further tests undertaken. It may also retain the service of such consultants or other persons that it considers are desirable.

(5)   The Commission shall be entitled to invite and consider submissions on such basis as it thinks appropriate.

[1 March, 2004][1]

Membership

The Hon. Mr. Justice Matthew P. Smith
Chairman

Mr. Kieran Coughlan
Clerk of Dáil Éireann

Ms. Deirdre Lane
Clerk of Seanad Éireann

Mr. Danny O'Hare
Chairman of the Information Society Commission and former President of Dublin City University

Mr. Brian Sweeney
Chairman of Siemens Ireland and former Chairman of Science Foundation Ireland

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[1] The terms of reference of 1 March 2004 were amended on 9 March 2004 as indicated in italics in paragraph (2) above.

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Part 1

Introduction
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1.1 Background and Scope

Establishment

The Commission on Electronic Voting was established by the Government on 1 March 2004 to report to the Ceann Comhairle (the Chairman of Dáil Éireann) not later than 1 May 2004 on the secrecy and accuracy of the Nedap/Powervote electronic voting system chosen by the Government for use at elections and referenda in Ireland – "the chosen system". It was also open to the Commission to review the tests already undertaken to validate the chosen system, to have further tests undertaken and to invite and consider submissions.

Five persons were invited by the Government to become members of the Commission which held its first meeting on 5 March.

The terms of reference of the Commission were amended by the Government on 9 March to provide that its report due not later than 1 May could comprise recommendations on the application or non-application of the chosen system for use at the local and European elections on 11 June 2004.

Legislation

Although the Commission was established on an ad-hoc basis, the Government indicated its intention to place the Commission on a statutory footing and the Electoral (Amendment) Bill 2004 initiated in Dáil Éireann on 23 March 2004 accordingly contained provisions relating to the Commission as well as in relation to electronic voting generally. The Bill remained under consideration by the Houses of the Oireachtas at the time of publication of this report.

General

In accordance with its terms of reference, the Commission considered the secrecy and accuracy of the chosen system and reviewed the tests that had been undertaken to validate it. The Commission decided that further tests should be carried out and these were undertaken in so far as possible. Procedures for the use of the system at elections were also examined.

Submissions were invited from the public and these were considered by the Commission, together with other documents and materials made available to it.

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Definitions

For the purposes of its work, the Commission has adopted the following interpretations of the terms "secrecy", "accuracy" and "tests":

"secrecy" is as defined in *McMahon v Attorney General*[2], namely, that the secret ballot must be secret to the voter, i.e. it relates to matters concerning the possible disclosure of how a voter has voted. In this context, the concept of secrecy does not relate to the disclosure of the intentions or actions of a person intending not to vote either by abstaining or deliberately spoiling their vote;

"accuracy" relates to matters concerning the demonstrable integrity and consistency of the methods for the gathering of the votes at polling stations, the methods for the translocation of the votes from the polling stations to the count centres and the methods for the counting and distribution of the votes;

"tests" includes subjecting the hardware and software elements of the voting and counting system equipment to physical and functional examinations and trials as regards their effectiveness and suitability for purpose. Testing of individual components may be carried out separately from combined testing of some or all of them together. As regards software, testing may include the inspection or examination of algorithms, pseudo-code or source code as well as the running of programs and applications using sample data. As regards hardware, testing may include examination of its physical and electronic properties as well as its operation in live or simulated test conditions. System documentation and designs may also be subjected to testing.

Scope

The work of the Commission concentrated primarily on the operation of the chosen system as it may be used at Irish elections, with particular emphasis on the local and European elections due to be held on 11 June.

While the holding of a constitutional referendum on the same day as these elections was announced after the Commission was established and was therefore not included in its terms of reference, the Commission considers that its conclusions in this report would be applicable to the referendum also but that this would of course be a matter for the Government and the Oireachtas, as the case may be.

In addition to the voting and counting operations at elections which are, in the context of this report, carried out by electronic means, the Commission has also determined that, while they are not central to its terms of reference, the administrative and other procedures surrounding the design, manufacture, transportation and custody of the system and its deployment and use at and between elections are also important factors which can have a bearing on secrecy and accuracy.

Exclusions

Although the public and parliamentary debates on the issue of electronic voting that took place both prior to and following the establishment of the Commission included a broad range of issues, not all of these issues fell within the scope of the Commission's work in accordance with its terms of reference.

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[2] *McMahon v Attorney General* [1972] IR 69, (1972) 106 ILTR 89.

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In particular, issues such as the existence of a voter verifiable audit trail, the removal of the possibility of abstaining or spoiling a vote, voter acceptance of the system, alternative electronic voting systems and issues surrounding the procurement of the chosen system and the procurement of previous testing of the system were outside the Commission's terms of reference.

In so far as it was feasible and appropriate for it to do so, the Commission nonetheless endeavoured to give due consideration to any issue coming to its attention which had a bearing on its work in relation to the secrecy and accuracy of the chosen system and the tests carried out to validate it.

Constraints

One of the main constraints on the work of the Commission was the limitation imposed by the very tight deadline within which it had to prepare and present this report. From its establishment on 1 March to the due date of this report on 1 May, there were just nine weeks in which to examine and report on the chosen system.

The Commission recognises that this was a limitation necessitated in turn by the prior announcement that the polls for the local and European elections would take place on 11 June.

A further constraint on the work of the Commission has arisen in the context of the presentation of this report. While the Commission had intended to present the full details of its work to date, it was considered prudent on the basis of legal advice received, to refrain from doing this until the legislation putting the Commission on a statutory footing is in place.

The Commission is hopeful that this will be done within a short timeframe, believing that the information gathered in the course of its work would make a significant contribution to the information about the chosen system that is available generally in the context of the public debate.

1.2 Approach and Methodology

Expert Assistance

Having decided at an early stage that further tests of the system were required and to that end, given the complexity and specialised nature of certain aspects of the subject matter, the Commission decided that expert assistance should be sought to carry out the work in the first instance in accordance with parameters set out by the Commission and subject to its approval, direction and control.

Individual persons and organisations having expertise in the areas of political science, computer science, public administration, audit, security and statistics were identified and were invited to submit proposals as to the approach and activities they would recommend to the Commission as being appropriate in the context of its terms of reference. These proposals were considered by the Commission and were agreed subject to modifications. Therefter, the reports presented by such experts were considered by the Commission.

On this basis, a substantial part of the work that underpins this report was carried out by expert persons for and on behalf of the Commission and the results are accordingly represented in this report. It is intended that the original work of the persons engaged by the Commission will be

published in a future report of the Commission and that it will be duly credited to the author or authors in each case.

Privacy and Confidentiality

The Commission considered it necessary and appropriate that its work should be carried out in a manner that was free from interruption, influence or interference and accordingly determined that it would meet and work in private. Persons engaged by the Commission were requested to observe confidentiality in their work and to declare any material interest they may have in the work of the Commission or in the outcome thereof. It is the intention of the Commission that this confidentiality should be maintained until the full details of its work have been presented in a future report.

Meetings

The Commission met on 13 occasions for the purposes of its work in connection with the preparation of this report.

Acknowledgements

The Commission would like to thank all the parties who co-operated with it in the preparation of this report including, in particular, the Department of the Environment, Heritage and Local Government.

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Part 2

Work of the Commission
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2.1 Introduction

As it is not possible for the Commission to present the full details of its work at this time, this part of the report merely summarises the work of the Commission in relation to the chosen system.

2.2 Review of the Electronic Voting System

The Commission obtained samples of the various hardware and software components of the chosen system from the Department of the Environment, Heritage and Local Government, together with documentation relating to the use of the system at elections in Ireland. The hardware and software components were examined as individual items and as a system. Previous tests were reviewed and the Commission decided that further tests should be carried out. This also included an examination of the source code for the counting software only. A list of the previous tests that were reviewed is set out at *Appendix 1*.

2.3 Review of the Procedures for Electronic Voting

The Commission reviewed the procedural guidelines issued to returning officers and other election personnel by the Department of the Environment, Heritage and Local Government and the system operation manuals prepared by the manufacturers of the chosen system. A risk analysis of the system was carried out and its security aspects were reviewed.

2.4 Other Matters

The Commission also considered the system in the context of the following matters:

• secrecy of the ballot;
• international experience of electronic voting;
• comparisons with the hand-counted voting system;
• rules for the counting of the votes;
• feasibility of implementing a verifiable audit trail.

The observations and conclusions of the Commission arising from its work are set out in *Part 4* of this report.

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Part 3

Public Submissions
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3.1 Introduction

By public notices in the newspapers on 11 and 14 March and by radio advertisements in the same period the Commission invited submissions from the public in relation to the secrecy, accuracy and testing of the chosen system. Submissions were to be received by 12 noon on 26 March.

Interested persons were advised that their submissions would be open to public inspection and may be published by the Commission.

162 submissions were received by post, by e-mail and on line at the Commission's website and a list of the persons and bodies from whom submissions were received is set out at *Appendix 2.*

These submissions, together with correspondence and other documentation received, were considered by the Commission.

It was the intention of the Commission to present the submissions it received as part of its first report, together with an summary and analysis of their content. However, in view of the legal constraints applying to the presentation of the other work of the Commission, it has decided to refrain from presenting the submissions at this time also.

3.2 Main Themes

The main themes of the submissions received may be summarised as follows:

- the need for a voter verified paper audit trail, to ensure that the accuracy of the results can be checked independently of the new system itself;

- the need to preserve the right to secrecy of a voter casting a blank ballot;

- the need to ensure that the final versions of the hardware and software used in the election are the precise versions that have been tested, approved and certified;

- the need for all software to be open source, to allow the wider community to check that it can generate accurate results; and

- the need for parallel running of the new system with the old paper one, once more to ensure the new system is generating accurate results.

While the first two of these themes raised in the submissions relate to matters falling outside of the Commission's terms of reference (but which are nonetheless acknowledged in this report as having a bearing on the successful implementation of the chosen system) the Commission has noted that the latter three concur broadly with the main themes of the Commission's work as summarised in *Part 4*.

Part 4

Summary and Conclusion

4.1 General Observations

On the basis of its investigations and its review of expert reports, submissions received and other relevant information, the Commission has noted the following in relation to the chosen system:

* the physical layout of the system is straightforward, contributing to ease of use by both voters and election officials;

* the system eliminates many inadvertent voter errors as well as the need for subjective judgment by returning officers;

* the system was deployed in pilot tests at previous elections and a referendum in Ireland;

* a system designed and manufactured by the same suppliers is in use at elections in the Netherlands and Germany;

* testing carried out by experts retained by the Commission on a significant sample of the voting machines deployed to returning officers confirms that the system can accurately and consistently record voter preferences;

* testing of the counting software carried out by experts retained by the Commission using voting information from pilot tests during previous elections in Ireland confirms that it accurately counted the votes recorded at these elections;

* parallel testing of the counting software programme carried out by experts retained by the Commission using a large number of sample data sets and a similar counting programme developed for the Commission confirms that it can accurately count votes in most situations, including unusual or difficult electoral situations;

* miniature end-to-end testing of the system carried out by experts retained by the Commission confirms that it can accurately record and count the votes in the context of multiple simultaneous elections;

* election results can be calculated and published quickly;

* use of the system may secure future reductions in election costs.

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4.2 Testing, Accuracy and Secrecy

However, and within the timeframe of this report, the Commission has not been able to satisfy itself sufficiently as to the accuracy and secrecy of the chosen system. The concerns of the Commission in this regard relate to the testing of the system as it would actually be deployed in June 2004.

Testing

The principal issues identified by the Commission in relation to the testing of the system are as follows:

- the software has been updated many times since the pilot elections in 2002 and since the full desk review of the source code:

  - the original desk reviews of earlier versions of the software continue to be relied upon as the baseline for evaluating the ongoing changes to the system that give rise to new versions,

  - there have been a large number of new versions of the software since the original desk reviews and tests took place,

  - as changes are made to the system, each new software version needs to be reviewed and tested in full before it can be relied upon for use in real elections,

  - it has not been possible for the Commission to review the impact of the changes made in successive versions of the software in time for inclusion in this report,

  - the fact that new versions of the software continue to be issued in the run-up to the June elections is unsatisfactory,

  - there is not sufficient time before the June elections for full testing of the final version of the software which would be essential before the software could be run in these elections;

- it has not been possible for the Commission to obtain access to the full source code of the system:

  - it has therefore not been possible to carry out the preliminary review of the full source code that might have been possible within the timeframe of this report,

  - a comprehensive review of the full source code of the system is necessary to establish its trustworthiness to a level compatible with the critical importance of voting at elections: such a comprehensive code review is outside the timeframe of this report,

  - there is not sufficient time before the June elections to allow a full code review of the final version of the software that would actually run in these elections;

- some components of the system have not been tested, in particular those at the interface between tested components;

- the tests of the system carried out to date are insufficient to establish its reliability for use at

elections in Ireland in June:

- there has been very limited "end-to-end" testing of the full system in its entirety as it would run in June, and none has been carried out independently: significant in this context is that the system as a whole will be required to register, combine, disaggregate, mix and count votes for up to four different polls being held at the same time,

- there has been no parallel testing of the system in a real election, either against the traditional manual system of voting or against an alternative electronic means; such parallel testing is very important for such a critical system as voting at elections: although the system was deployed on a pilot basis in 2002, these elections were not run in parallel with a paper ballot, and the software has been modified many times since then;

- the system has not been tested as a whole or certified as being suitable for use in an Irish electoral context by an accredited testing and certification authority.

Accuracy

The principal issues identified by the Commission in relation to the accuracy of the proposed system largely follow from the Commission's concerns about testing:

- as the software version proposed for use at the forthcoming elections is not as yet finalised, it is impossible for anyone to certify its accuracy;

- the issues set out above in relation to the testing of the system make it impossible to determine its accuracy in the context of this report;

- certain of the tests performed at the request of the Commission identified an error in the count software which could lead to incorrect distributions of surpluses; there is a possibility that further testing will uncover further software errors;

- while eliminating the possibility of certain types of inadvertent voter error, the chosen system introduces the possibility of new types of error in the use by electors of the voting machine, particularly in the context of a number of simultaneous polls;

- there is a possibility of interference with the voting machine, ballot module and hardened PC:

  - in particular, experts retained by the Commission found it very easy to bypass electronic security measures and gain complete control of the "hardened" PC, overwrite the software, and thereby in theory to gain complete control over the count in a given constituency,

  - the examinations carried out by the Commission's experts suggests that these "hardened" PCs are the weakest link in the security of the proposed system and it is significant that there appears to have been no systematic testing and certification of the "hardening" of the PCs notwithstanding their susceptibility to either inadvertent error or deliberate manipulation by those with access to them;

- the system allows the inadvertent use of outdated versions of the software, as well as the overwriting of the software with replacement software;

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- attention is required to procedural issues and controls regarding the storage, handling, deployment and use of the equipment by election personnel as contained in the documentation issued to returning officers.

Furthermore, in the context of the June elections, in which each elector would be asked to use the same voting machine to vote simultaneously on a number of different matters, it is important to note that accuracy in the translocation and counting of votes critically involves the system for the aggregation of votes from many different polling machines, followed by their subsequent disaggregation, then separate mixing and counting in local and European elections, as well as the proposed referendum.

Secrecy

The principal issues identified by the Commission in relation to the secrecy of the system are as follows:

- the voting machine "beeps" as preferences are being selected, and to signal voter errors; this allows limited inferences to be drawn by those outside the polling booth about the number of preferences cast: in particular a voter voting for a single candidate would be easy to identify by those in the vicinity of the machine;

- there is reduced voting secrecy for persons with certain disabilities (although this is not a legal issue in the sense that, in *McMahon v Attorney General* the Court held that the right to secrecy is not an absolute one) as well as for persons who are unfamiliar with technology and who may need third-party assistance in using the machine;

- publication of ballot results in full is a valuable aid in checking the accuracy of the results but this can in theory reveal deliberate voter "signatures" of low-preference votes which could allow voters to identify themselves in a context of corruption or intimidation;

- it may be possible for an insider to overcome the randomness of the method used for the storage of votes in the ballot module.

4.3 Overall Conclusion

The Commission accordingly concludes that, having regard to the issues of secrecy, accuracy and testing as set out in its terms of reference, it is unable to recommend the use of the proposed system at the local and European elections and, by extension, at the referendum due to be held on 11 June.

The Commission wishes to emphasise that its conclusion is not based on any finding that the system will not work, but on the finding that it has not been proven at this time to the satisfaction of the Commission that it will work.

In addition, the Commission recognises that the threshold of proof required to support its recommendation against the use of the proposed system is much lower than that which would be required to recommend in its favour. It is for this reason that, although its work is incomplete, the Commission is in a position to make its recommendation within the timeframe of this report.

4.4 Other Issues

The Commission also makes the following observations in relation to the chosen system which, although not falling strictly within its terms of reference, have a bearing on the successful implementation of the system at elections in Ireland:

- under the system, voters who wish to register an abstention by voting for no candidate cannot do so in secrecy;

- the system does not have a voter-verifiable audit trail (VVAT), argued by many to:

  - reassure voters that their vote has been correctly recorded,

  - create a disincentive to the manipulation of the system by providing an external check on accuracy,

  - enable recovery from a serious system failure;

- the absence of a VVAT significantly raises the standards and quality of other system testing that is required;

- the proposed system focuses a large number of new responsibilities on returning officers: it has been argued that an explicit and carefully specified "segregation of duties" between different election officials would increase safeguards against errors being made or improper manipulation by a single person operating parts of the system away from public scrutiny;

- although it has the potential to be able to carry out calculations to a higher degree of perfection than the hand counting method, the system has been designed to replicate, but in a consistent manner, the inaccuracy inherent in the current vote counting rules as regards the transfer of surpluses.

Furthermore, one consequence of retaining the current counting rules as regards the initial mixing of the votes and for the random selection of votes on the transfer of a surplus is that if a manual re-count of an election were required (as in the case of an election petition) it would not be possible to achieve the same result in a hand count as in the original electronic count, in view of the different random selections that would be made in each case.

In short, retaining the random element in surplus distribution makes it inherently more difficult to check the accuracy of the proposed system using a manual recount and this therefore has a bearing on the value of VVAT in the context of the chosen system.

This could only be avoided by a change in the electoral law to dispense with random selection in favour of a counting method such as "the Gregory rules". This, in turn, would enhance electronic voting by allowing computer systems to be used to their full capacity and would, more importantly, be more democratic in that every preference would be taken into account.

In making these observations the Commission is not advocating any particular view on the issues raised but is including them in its report in the interests of completeness.

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4.5 Recommendations for Action

The following additional work will be required for the Commission to be in a position to satisfy itself as to the secrecy and accuracy of the system:

- there needs to be a final definitive version of the software and all related hardware and software components to be used at elections in Ireland;

- there then needs to be a full independent review and testing of the source code of the final system to be used: any subsequent software modification will necessitate a further full system re-test;

- there should be independent parallel testing of the system, including where possible in a live electoral context;

- there should be independent end-to-end testing of the system;

- there should be testing and certification by a single accredited body of the suitability of each new version of the entire system for use at elections in Ireland.

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Appendix 1

Tests Reviewed

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Zerflow   Electronic Voting Security Assessment 27/03/02
                  Review 4/07/03

PTB   Test Report 17/09/03*
                  Test Report 2 17/09/03*
                  Software Requirements for Voting Machines 18/03/03*
                  Test Report 8/09/98

TNO   Test Report: Program Reading Unit Model ESI 1 28/10/03*
                  Test Report: Voting Machine Type ESI 2 (Standards IEC 60839-1-2, etc) 30/06/03*
                  Test Report: Voting Machine Type ESI 2 (Standards IEC 60839-1-3) 29/10/03*
                  Test Report: Voting Machine Model PRU (Standards EN 50082-2, etc) 6/08/03*
                  Test Report: Voting Machine Model PRU (Standards IEC 60068-2, etc) 8/08/03*

KEMA   Certificate No. 2028725.01 issued to NEDAP 20/6/03*

ERS   Software Validation Report, 15/12/03*
                  Report of 22/03/04*

Nathean   Code Review of IES Build 0111 23/12/03*
                  Architectural Assessment and Code Review of IES for use at June 2004 Elections 23/12/03*
                  Code Review of IES Build 132 – Election Setup and Maintenance 20/04/04*
                  Code Review of IES Build 132 – Vote Reader 20/04/04*
                  Code Review of IES Build 132 – Irish Election Processing 20/04/04*

Bureau Veritas Report on Evaluation of Nedap machine 2/02/04

PMI   Code review 14/12/01
                  Database Evaluation 14/12/01
                  Development Environment 14/12/01
                  Guidelines for Review 14/12/01
                  Pseudo Code Reference 14/12/01
                  Random Numbers 14/12/01

*available at www.electronicvoting.ie

Appendix 2

Public Submissions

1. Patrick O'Beirne
2. Charles Flanagan
3. Ann Burns
4. Roy Madden
5. David Bateman
6. Dr. Roy H W Johnston
7. Francis Butler
8. Alan Jones
9. John McGinley
10. Jim Harding
11. John Fintan Fitzgerald
12. Michael and Ethna Viney
13. P.M. Boyle
14. Ben Cranks
15. Frank Mason
16. Brendan Farrell
17. Tommy Weir
18. Kiernan Burke
19. Tom Coughlan
20. Tom O'Seitheacháin
21. Kiernan Burke
22. Geraldine Bird
23. Michael Mac Biorthagra
24. Aidan O'Hara
25. John Burke
26. George Mullan
27. Bobby Carty
28. Thomas Long
29. Yvonne Slattery
30. Stephen Geraghty
31. Fergal Shevlin
32. Milo Doyle
33. Donal O'Callaghan
34. Antoin O Lachtnain
35. Kieran O'Sullivan
36. Paul Donnelly
37. John Timmons
38. Philip Newton
39. David Algeo
40. Pat O'Flaherty
41. Peter Barrett
42. Mark Wakefield
43. Paul Casey
44. Raymond McCarthy
45. Dáire Mag Cuill
46. John Morrison
47. Kiernan Burke
48. Seán Shelly
49. "user"
50. Donal Kelly
51. John Reid
52. Michael Farrell
53. Michael Prendergast
54. Meg Dunne
55. Andrew Ogle
56. Tommy Broughan, T.D.
57. Gerard Lardner
58. A. Leavy
59. Cllr. Niamh Bhreathnach
60. Donal O'Callaghan
61. Rory Donegan
62. Liam J. McMullin
63. Dermot Dunnion
64. David O'Higgins
65. Dr. Michael Purser
66. Pat Kearney
67. P.J. Kerr
68. Labour Party
69. Timothy J. Lane
70. Conor Lennon
71. John Horan
72. Ingrid Masterson
73. James Dillon-Kelly
74. John Morahan

75. Brendan Magee
76. Michael Malone
77. Cllr. Michael Colreavy
78. Michael Burke
79. Dr. Don Mac Auley
80. Paul Donnelly
81. Michael Tierney
82. Brian Mathews
83. Liam Caffrey
84. Frank Butler
85. Roscommon County Council
86. Frank Flanagan, Michael Ryan and Seamus Farrell
87. Paul Holden
88. Frank Nuttall
89. Malachy Murphy
90. Celia Kehoe
91. Irish Citizens for Trustworthy Evoting
92. William Grogan
93. Tom Fennelly
94. Christopher Murray
95. Michael Monaghan
96. Dr. Dervilla McKeith
97. Jason Kitcat
98. Powervote Ireland Ltd
99. Ciaran Finn
100. Shane Hogan
101. John Kennedy
102. Irish Computer Society
103. Donal Cullen
104. Cllr. Austin Berry
105. Dr. Kevin Farrell
106. 'At What Cost?'
107. Edith Wynne
108. Timothy Murphy
109. John Lambe
110. Department of the Environment, Heritage and Local Government
111. Dennis Jennings
112. Meadhb Piskorska
113. David Campbell
114. Joe McCarthy
115. Aengus Lawlor
116. Karen Devine
117. Edward Goroy
118. John Fair
119. Úna Power
120. Ryszard Piskorski
121. Ken Healy
122. John P. Crimmins
123. Thomas Euferafus Griffin
124. Seán Dineen
125. Mary Tierney
126. Senator James Bannon
127. Ferdia (as Cathair na Gaillimhe)
128. James A.V. Mortell
129. Brigid Rodriguez
130. Professor David Lorge Parnas
131. Patrick and Anne Cahill
132. Breeda Kelleher
133. Niall O'Keeffe
134. A dissatisfied voter
135. Gertrud O'Sullivan
136. Brendan Atkinson
137. Patrick Fagan
138. Bernadette Tierney
139. M J Boyle
140. Cllr. Joe Brennan
141. Green Party/Comhaontas Glas
142. James Cotter
143. Thomas J. Mullally
144. Ciaran Quinn
145. The Workers' Party
146. Fine Gael Party
147. Robert McGarry
148. Padraig McCarhy
149. F.X. O'Brien
150. Ronan O'Dwyer
151. Henry Byrne
152. Niall Ó Tuathail
153. Charles Roche
154. Paul Brennan
155. SC
156. The Scanlon Family
157. William Campbell
158. Stephen OMeara
159. Dr. David Malone
160. Michael McMahon
161. Stephen G Ellis
162. Dr. Christophe Meudec