GAO BRIEFING ON THE STATUS OF THE INVESTIGATION INTO THE FL–13 CONGRESSIONAL DISTRICT ELECTION

MEETING

BEFORE THE

COMMITTEE ON HOUSE ADMINISTRATION

TASK FORCE FOR THE CONTESTED ELECTION IN THE 13TH CONGRESSIONAL DISTRICT OF FLORIDA

HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

MEETING HELD IN WASHINGTON, DC, OCTOBER 2, 2007

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GAO BRIEFING ON THE STATUS OF THE INVESTIGATION INTO THE FL–13 CONGRESSIONAL DISTRICT CONTESTED ELECTION

TUESDAY, OCTOBER 2, 2007

HOUSE OF REPRESENTATIVES,
TASK FORCE ON FLORIDA–13,
COMMITTEE ON HOUSE ADMINISTRATION,
Washington, DC.

The committee met, pursuant to call, at 4:05 p.m., in Room 1310, Longworth House Office Building, Hon. Charles A. Gonzalez [chairman of the task force] presiding.

Present: Representatives Gonzalez, Lofgren, McCarthy, Ehlers, and Lungren.

Staff Present: Thomas Hicks, Senior Election Counsel; Janelle Hu, Election Counsel; Jennifer Daehn, Election Counsel; Matt Pinkus, Professional Staff Member/Parliamentarian; Kristin McCowan, Chief Legislative Clerk; Daniel Favarulo, Staff Assistant; Matthew DeFreitas, Staff Assistant; Kyle Anderson, Press Director; Gineen Beach, Minority Counsel; and Bryan Dorsey, Minority Professional Staff Member.

Mr. GONZALEZ. I am going to call the meeting of the Task Force on Florida–13—this is a public meeting, of course, and it is going to be called to order.

The record will reflect that I am Charles Gonzalez, and I am the chairman of the task force. And I am joined today by another member of the task force, Kevin McCarthy, a Congressman from California. And we have also Dan Lungren, who is not officially a member of the task force but has attended different meetings and hearings that we have had, and briefings. Congresswoman Zoe Lofgren, the third member of the task force, is delayed presently but will be joining us.

Recognizing that we are probably going to have votes in about 30 minutes, we are going to try to get as much done as possible today. The witnesses that we have here—and I believe we may be hearing from all three if necessary, but I will start with the easier names. And that is going to be Jan Montgomery and Gloria Jarmon, and then we have Dr. Naba Barkakati, which is pretty good after all this time. Because I believe it is going to be Dr. Barkakati that is going to actually be making the report.

By way of background, we had a briefing last week. A draft report was being prepared. It had to be vetted, basically, if you want to call it that, or presented to ES&S, the manufacturer of the voting machines in question, as well as Florida election officials, for

their input, their comments and so on. My understanding is that has been completed, and today GAO will be making a report to us that should answer the question about whether there is a need for further testing.

And with that, I will turn it over to the GAO representatives.

Mr. BARKAKATI. Thank you. Mr. Chairman, Members——

Mr. GONZALEZ. If we could hold on——

Mr. BARKAKATI. Sorry.

Mr. GONZALEZ. And I am sorry.

I apologize to Congressman McCarthy. If any Member wishes to make an opening statement, we can do so at the present time.

Mr. MCCARTHY. I thank Chairman Gonzalez.

Today's public hearing will analyze the GAO's report that summarizes the investigation of the Florida-13 congressional election that took place almost a year ago between Congressman Buchanan and Ms. Jennings.

I thank our witnesses for returning to publicly report their findings thus far and for their continued cooperation to keep the task force informed and to brief members last week.

I am pleased that all parties are working well together. In what could be a contentious struggle to get information from the courts, the state, the vendors and experts, the GAO has received cooperation from all parties as it has gone over studies that have already been done and as it has formulated plans of further studies, checked protocols and rechecked protocols.

The results of this investigation thus far seems to clearly point that there is no smoking gun, no evidence that the voting system would have caused the undervote, a conclusion similar to what Sarasota County, the State of Florida and the independent teams of experts have already derived.

Right now, based upon GAO's findings, we seem to be nearing the conclusion of this contested election so that GAO can corroborate its findings with reasonable certainty on what it has found thus far, and that there is no evidence that voting systems caused undervotes and that the undervotes could instead have occurred because voters intentionally undervoted or did not properly cast their ballots, perhaps due to the ballot design.

The GAO is recommending that it conduct a few additional tests. I credit the GAO with its professional undertaking of this very difficult responsibility in response to the task force's request. I agree with the GAO recommendations to move forward with those additional tests so it can make its eventual recommendation with the reasonable certainty and finally put to rest for the people of the 13th District of Florida the challenge against Congressman Vern Buchanan.

And I yield back the balance of my time.

[The statement of Mr. McCarthy follows:]

Opening Statement: Task Force GAO Hearing
October 2, 2007
Congressman Kevin McCarthy

Thank you for recognizing me for an opening statement, Chairman Gonzalez.

Today's public hearing will analyze the GAO's report that summarizes its investigation of the Florida 13 congressional election that took place almost a year ago between Congressman Buchanan and Ms. Jennings. I thank our witnesses for returning to publicly report their findings thus far and for their continued cooperation to keep the task force informed, as they briefed members last week.

I am pleased that all parties are working well together. In what could have been a contentious struggle to get information from courts, the state, the vendors, and experts, the GAO has received cooperation from all parties as it has gone over studies that have already been done, and as it has formulated plans of further studies, checked protocols, and rechecked protocols.

The result of this investigation thus far seems to clearly point that there is no smoking gun. No evidence that the voting system would have caused the undervote, a conclusion similar to what Sarasota County, the State of Florida and independent teams of experts have already derived. Right now, based on the GAO's findings, we seem to be nearing the conclusion of this contested election. So that the GAO can corroborate its findings with "reasonable certainty" on what it has found thus far -- that there is no evidence that voting systems caused undervotes and the undervotes could instead have occurred because voters intentionally undervoted or did not properly cast their ballots, perhaps due to the ballot design -- the GAO is recommending that it conduct a few additional tests.

I credit the GAO with its professional undertaking of this very difficult responsibility in response to this Task Force's request. I agree with the GAO's recommendations to move forward with those

additional tests so that it can make its eventual recommendation with a "reasonable certainty" and finally put to rest for the people of the 13th District of Florida the challenge against Congressman Vern Buchanan.

Mr. GONZALEZ. Thank you very much, Congressman McCarthy. And at this time, we will turn it over to the witnesses.

STATEMENT OF MR. NABAJYOTI BARKAKATI, SENIOR-LEVEL TECHNOLOGIST, APPLIED RESEARCH AND METHODS, U.S. GOVERNMENT ACCOUNTABILITY OFFICE

Mr. BARKAKATI. Thank you, Mr. Chairman.

Mr. Chairman, Members of the task force, I am here today to present our findings regarding the Florida–13 review.

Thanks in large part to the task force's continued support, we have had good cooperation from all parties involved, and we have been able to access all the information we needed to study whether the voting systems contributed to the undervote in the Florida–13 race in Sarasota County's 2006 general election.

In that election, Sarasota County used ES&S voting systems, specifically the Unity Election Management System and 1,499 iVotronic direct recording electronic, DRE, touchscreen machines, during the early voting and Election Day voting days.

Our independent analysis of the 2006 general election data from the county, Sarasota County, confirmed the unusually large number of undervotes there in the Florida-13 race, and we found that the undervotes were generally distributed across all precincts and all machines.

We found that the prior reviews and testing provided reasonable assurance that the Unity Election Management System did not contribute to the undervote, and the votes captured by the iVotronic DREs within the precincts matched the voter count from the precinct registers within an acceptable range of errors.

However, these tests do not provide enough information to determine whether the iVotronics contributed to the undervote or not. The firmware comparison and parallel tests, which were done as part of Florida State's audit of the Sarasota County elections, provided useful information, but the results could not be applied to all iVotronics because the number machines that were tested was small. Additionally, the machines were not tested for all the different ways that the voter could have cast votes using the machines—a feature of an iVotronic machine. We also did not find prior testing of what happens when a touchscreen is deliberately miscalibrated.

To address these issues, we are proposing three tests: a firmware verification test; a ballot test; and a calibration test, which should be conducted to try to obtain further assurance that the iVotronic DREs used in the Sarasota County elections did not cause the undervote.

The proposed firmware verification test is similar to the one that was conducted by Florida State on six machines, but, in this case, we are conducting on a larger population. It is going to test a representative sample of iVotronic DREs and compare its installed firmware with the certified version.

The ballot test is going to exercise the different ways of casting ballots, selecting candidates and casting a vote on 10 iVotronic DREs.

The calibration test would deliberately miscalibrate an iVotronic DRE and then test it to verify whether it works properly.

We estimate that all three tests would take 2 weeks using a staff of about six to eight people, once we have made all the arrangements necessary for the tests.

Should the task force ask GAO to conduct these tests, several matters need to be addressed before the testing could begin. We would need to obtain access to the machines that are currently sequestered under a court order. We have to arrange for a test site, obtain some tools that are needed for firmware verification tests, develop the test protocols and test procedures, and arrange for a video recording of the test.

Sarasota County election officials have told us that, working around their current election schedule, they can help GAO access the machines and provide a test site between November 26 and December 7, 2007.

Before I conclude, I should mention that we recognize that human interaction with the ballot layout could have been a potential cause of the undervote. And although we have not explored this issue in our review, we note that there is an ongoing academic study that is exploring this issue using machines from ES&S, the same manufacturer. We believe that such experiments could be useful and could provide insight into the ballot layout issue.

We also noted that there are several suggestions which have been offered as possible ways to establish that the voters are intentionally undervoting and the machines are not causing the undervote.

First, a voter-verified paper trail could provide an independent confirmation that the touchscreen machines did not malfunction in recording and counting the votes.

Second, providing explicit feedback of the undervote and requiring positive verification before casting the ballot with an undervote might just prevent many voters from unintentionally undervoting.

And third and finally, offering a "none of the above" option in a race could provide the voters with an option that enables them to indicate that they are intentionally undervoting.

However, we emphasize that any decision about these or other suggestions about ballot layout or things related to the voting system functions should be informed by human-factors studies that assess their effectiveness in accurately recording the voters' intentions and making the voting systems easier to use and preventing unintentional undervotes.

In conclusion, the prior tests and reviews of the Sarasota County 2006 election have provided valuable information about their voting systems. Our review has found that, in many cases, we could rely on those results—on that information to eliminate areas of concern. This has allowed us to identify the areas where increased assurances are needed to answer the questions being raised. Accordingly, the primary focus of the tests we are proposing is to obtain reasonable assurance that the results of prior reviews, as well as our proposed tests, could be applied to all the iVotronic DREs that were used in the 2006 election.

However, even after completing all the proposed tests, we would not be able to provide absolute assurance that the iVotronics did not play any role in the large undervote because we are unable to recreate the exact conditions of the election in 2006.

By successfully conducting the tests, however, we are going to be able to reduce the possibility that the machines were the reason of the undervote and shift attention to the other possibilities that the voters either intentionally undervoted or did not properly cast their ballot on the iVotronic, potentially because of issues related to the interaction between the voter and the ballot.

Mr. Chairman, this concludes the summary of my written statement. I would be happy to respond to questions at this time from you and other Members of the task force. Thank you.

[The statement of Mr. Barkakati follows:]

United States Government Accountability Office

GAO

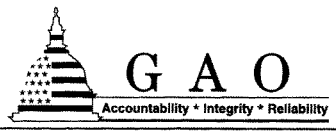
Statement before the Task Force on Florida-13, Committee on House Administration, House of Representatives

For Release on Delivery
Expected at 4:00 p.m. EDT
Tuesday, October 2, 2007

ELECTIONS

Further Testing Could Provide Increased but Not Absolute Assurance That Voting Systems Did Not Cause Undervotes in Florida's 13th Congressional District

Statement of Dr. Nabajyoti Barkakati
Senior-Level Technologist
Applied Research and Methods



GAO-08-97T

October 2, 2007

GAO
Accountability·Integrity·Reliability
Highlights

Highlights of GAO-08-97T, a statement before the Task Force on Florida-13, Committee on House Administration, House of Representatives

ELECTIONS

Further Testing Could Provide Increased but Not Absolute Assurance That Voting Systems Did Not Cause Undervotes in Florida's 13th Congressional District

Why GAO Did This Study

In November 2006, about 18,000 undervotes were reported in Sarasota County in the race for Florida's 13th Congressional District (FL-13). After the contesting of the election results in the House of Representatives, the task force unanimously voted to seek GAO's assistance in determining whether the voting systems contributed to the large undervote in Sarasota County. GAO agreed with the task force on an engagement plan, including the following review objectives: (1) What voting systems were used in Sarasota County and what processes governed their use? (2) What was the scope of the undervote in Sarasota County in the general election? (3) What tests were conducted on the voting systems in Sarasota County prior to the general election and what were the results of those tests? (4) Considering the voting systems tests conducted after the general election, are additional tests needed to determine whether the voting systems contributed to the undervote? To conduct its work, GAO met with officials from the State of Florida, Sarasota County, and Election Systems and Software (ES&S)—the voting systems manufacturer—and reviewed voting systems test documentation. GAO analyzed election data to characterize the undervote. On the basis of its assessments of prior testing and other activities, GAO identified potential additional tests for the Sarasota County voting systems.

To view the full product, including the scope and methodology, click on GAO-08-97T. For more information, contact Keith Rhodes at (202) 512-6412 or rhodesk@gao.gov, or Naba Barkakati at (202) 512-4499 or barkakatin@gao.gov.

What GAO Found

In the 2006 general election, Sarasota County used voting systems manufactured by ES&S, specifically iVotronic direct recording electronic (DRE) voting systems during early and election day voting and the Unity election management system, which handles the election administration functions, such as ballot design and election reporting.

GAO's analysis of the 2006 general election data from Sarasota County did not identify any particular voting machines or machine characteristics that could have caused the large undervote in the FL-13 race. The undervotes in Sarasota County were generally distributed across all machines and precincts.

GAO's analysis found that some of the prior tests and reviews conducted by the State of Florida and Sarasota County provide assurance that certain components of the voting systems in Sarasota County functioned correctly, but they are not enough to provide reasonable assurance that the iVotronic DREs did not contribute to the undervote. Specifically, GAO found that assurance is lacking in three areas, and proposes that tests be conducted to address those areas. First, because there is insufficient assurance that the firmware in all the iVotronic DREs used in the election matched the certified version held by the Florida Division of Elections, GAO proposes that a firmware verification test be conducted on a representative sample of 115 (of the 1,499) machines that were used in the general election. Second, because an insufficient number of ways to select a candidate in the FL-13 race were tested, GAO proposes that a test be conducted to verify all 112 ways that GAO identified to select a candidate. Third, because no prior tests were identified that address the effect of a miscalibrated iVotronic DRE on the undervote, GAO proposes that an iVotronic DRE be deliberately miscalibrated to verify the accurate recording of ballots under these conditions. GAO expects these three tests would take 2 weeks, once the necessary arrangements are made.

Should the task force ask GAO to conduct the proposed tests, several matters would need to be addressed before testing could begin, including obtaining access to the iVotronic DREs that have been subject to a sequestration order, arranging for a test site, obtaining some commercially available test tools, developing test protocols and detailed test procedures, and arranging for the video recording of the tests. Sarasota County election officials have indicated that they can help GAO access the machines and provide a test site between November 26 and December 7, 2007.

Although the proposed tests could help provide increased assurance, they would not provide absolute assurance that the iVotronic DREs did not cause the large undervote in Sarasota County. The successful conduct of the proposed tests could reduce the possibility that the voting systems caused the undervote and shift attention to the possibilities that the undervote was the result of intentional actions by voters or voters that did not properly cast their votes on the voting system.

Mr. Chairman and Members of the Task Force:

I am pleased to appear before the task force today to present the findings on our review of voting equipment used in Florida's 13th Congressional District (Florida-13), which we are conducting in response to your request of May 25, 2007.

In November 2006, about 18,000 undervotes were reported in Sarasota County in the race for Florida's 13th Congressional District.[1] Following the contesting of the election results in the House of Representatives, the task force met and unanimously voted to seek GAO's assistance in determining whether the voting systems contributed to the large undervote in Sarasota County. On June 14, 2007, we met with the task force and agreed upon an engagement plan, which included the following review objectives:
(1) What voting systems and equipment were used in Sarasota County and what processes governed their use? (2) What was the scope of the undervote in Sarasota County in the general election? (3) To what extent were tests conducted on the voting systems in Sarasota County prior to the general election and what were the results of those tests?
(4) Considering the tests that were conducted on the voting systems from Sarasota County after the general election, are additional tests needed to determine whether the voting systems contributed to the undervote?

To conduct our work, we met with officials from the Sarasota County Supervisor of Elections, the Florida Department of State and Division of Elections, and Election Systems and Software (ES&S), the manufacturer of the voting systems used in Sarasota County. We reviewed voting system documentation, including standards documents, audit and testing documentation, submissions from the contestant and contestee, and selected Florida election laws and rules. In Sarasota County, election officials demonstrated how the ES&S voting system was used to support the 2006 general election. To determine the scope of the undervote in Sarasota County, we collected election data from the Supervisor of Elections and analyzed it to determine whether the undervote could be attributed to particular voting machines or machine characteristics. Specifically, we examined ballot image logs and event logs from the voting systems and technician and incident reports generated by elections staff

[1]Undervotes occur when the number of choices selected by the voter is fewer than the maximum allowed for that contest. In this case, it means ballots that did not record a selection for either candidate in the congressional contest.

from Sarasota County on election day. We also conducted various statistical analyses to characterize the undervote and to identify whether a subset of machines or precincts may have caused the large undervote.

We reviewed test documentation and interviewed officials involved with testing from ES&S, the Florida Division of Elections, and the Sarasota County Supervisor of Elections. To determine the need for additional tests, we also reviewed the tests conducted following the election, including those conducted or sponsored by the Florida Division of Elections, including the parallel testing, the examination of Sarasota County's election procedures and practices, and the source code review conducted at Florida State University's Security and Assurance in Information Technology (SAIT) laboratory. We reviewed the final reports of these tests and also met with the leader of the source code review team. Following the agreement to and execution of a non-disclosure agreement with the Florida Department of State and ES&S, we obtained access to the iVotronic source code and reviewed it to further our understanding of the system and to verify some of the source code review's findings. We analyzed the available information and identified a key set of voting system objectives that, if implemented properly, would provide reasonable assurance that the voting systems did not malfunction and cause the large undervote in Sarasota County. Using these objectives, we used the results of testing previously conducted and assessed the extent to which these key voting system objectives could be met. For those objectives that could not be adequately assured, we assessed the significance of those objectives and identified tests that could be conducted to help try to assure those key voting system objectives were met. For each test, we identified resources that would be required, including time and manpower.

We provided a draft of this report to the Florida Department of State, ES&S, and the Sarasota County Supervisor of Elections for their review and comments. The Florida Department of State and ES&S also conducted a sensitivity review to ensure that business proprietary information is not disclosed in this statement.

We conducted our work from June to September 2007 in Washington, D.C.; Tallahassee and Sarasota, Florida; and Omaha, Nebraska.

Results in Brief

In the 2006 general election, Sarasota County used voting systems manufactured by ES&S, specifically iVotronic direct recording electronic (DRE) voting systems during early and election day voting and the Unity

election management system, which handles the election administration functions, such as ballot design and election reporting.

Our independent analysis of the 2006 general election data from Sarasota County confirmed the large undervote in the race for Florida's 13th Congressional District, but did not identify any particular voting machines or machine characteristics that could have caused the large undervote in the election. The undervotes in Sarasota County for the congressional race were generally distributed across all machines and precincts.

We found that some of the prior tests and reviews provide assurance that the voting systems in Sarasota County functioned correctly, but they are not enough to provide reasonable assurance that the iVotronic DRE voting systems did not contribute to the undervote. For example, prior reviews provide reasonable assurance that the Unity election management system did not contribute to the undervote, and the votes captured by iVotronic DREs at the precincts match the voter count from precinct records within acceptable margins of error.

Portions of the Florida state audit, such as the firmware comparison and parallel tests, provided useful information, but the results could not be applied to all the iVotronic DREs used in the election because the number of machines tested was too small. Additionally, the machines were not tested for all different ways a voter can select a candidate in the congressional race. We also did not find any prior testing that would help us understand the effects of a miscalibrated touch screen. To address these issues, we propose that (1) a firmware verification test, (2) a ballot test, and (3) a calibration test be conducted to try to obtain further assurance that the iVotronic DREs used in Sarasota County during the 2006 general election did not cause the undervote. The firmware verification test would compare the firmware in a representative sample of iVotronic DREs with the certified version of firmware. The ballot test would exercise 112 ways to select a candidate on 10 iVotronic DREs. The calibration test would deliberately miscalibrate an iVotronic DRE that uses the certified software and verify the functioning of the machine. We expect the testing would take 2 weeks using a staff of about 6 to 8 people, once the necessary arrangements have been made. Although the proposed tests would provide increased assurance, they would not conclusively eliminate the machines as a cause of the undervote.

Before commencing the testing, we would need to obtain access to the iVotronic DREs that have been subject to a sequestration order in the state court system of Florida, arrange for a test site, obtain some commercially

available software and hardware for the firmware comparison test, develop test protocols and detailed test procedures, and arrange for video recording of the test. Sarasota County election officials have indicated that working around the county's election schedules, they could help us access the machines and provide a test site between November 26 and December 7, 2007.

Our proposed tests could help reduce the possibility that the undervote was caused by the iVotronic DREs. However, even after completing the tests, we would not have absolute assurance that the iVotronic DREs did not play any role in the large undervote. Absolute assurance is impossible to achieve because we are unable to recreate the conditions of the election in which the undervote occurred. By successfully conducting the proposed tests, we could reduce the possibility that the iVotronic DREs were the cause of the undervote and shift attention to the possibilities that the undervote was the result of intentional actions by the voter or voters that did not properly cast their votes on the voting system.

Draft copies of this statement were provided to the Secretary of State of Florida, the Supervisor of Elections of Sarasota County, and ES&S for their review and comment. The Florida Department of State provided technical comments, which we incorporated. The Sarasota County Supervisor of Elections did not provide us comments.

In its comments, ES&S stated that it believes that the collective results of prior testing have demonstrated that the voting systems worked properly in Florida's 13th Congressional District race, and that the focus should be on testing the effect of the ballot display on the undervote. We disagree that the prior test results adequately demonstrate that the voting systems could not have contributed to the undervote. Our analysis identified three areas where further testing could provide increased assurance that the undervote was not caused by the voting systems. We agree with ES&S that the large undervote in Florida's 13th Congressional District race could have been caused by voters who intentionally undervoted or voters who did not properly cast their ballots, potentially because of issues related to the human interaction with the ballot. However, our review focused on whether the voting systems could have contributed to the large undervote. ES&S also provided technical comments, which we incorporated as appropriate.

Background

The 13th Congressional District of Florida comprises DeSoto, Hardee, Sarasota, and parts of Charlotte and Manatee Counties. In the November 2006 general election, there were two candidates in the race to represent the 13th Congressional District: Vern Buchanan, the Republican candidate, and Christine Jennings, the Democratic candidate. The State of Florida certified Vern Buchanan the winner of the election. The margin of victory was 369 votes out of a total of 238,249 votes counted. Table 1 summarizes the results of the election and shows that the results from Sarasota County exhibited a significantly higher undervote rate than in the other counties in the congressional district.

Table 1: Results from 2006 General Election for Florida Congressional District 13

County	Buchanan	Jennings	Undervotes	Total ballots cast	Percentage undervote
Charlotte	4,460	4,277	225	8,962	2.51
DeSoto	3,471	3,058	142	6,672	2.13
Hardee	2,629	1,686	269	4,584	5.87
Manatee	50,117	44,432	2,274	96,828	2.35
Sarasota	58,632	65,487	18,412	142,532	12.92
Total	**119,309**	**118,940**	**21,322**	**259,578**	

Source: GAO analysis of Florida Division of Elections, Charlotte County, DeSoto County, Hardee County, Manatee County, and Sarasota County data.

Note: Numbers do not add up because of overvotes – where voters select more than the maximum number of candidates allowed in a race; in this case, a ballot that had votes for both Buchanan and Jennings.

In Florida, the Division of Elections in the Secretary of State's office helps the Secretary carry out his or her responsibilities as the chief election officer. The Division of Elections is responsible for establishing rules governing the use of voting systems in Florida. Voting systems cannot be used in any county in Florida until the Florida Division of Elections has issued a certification of the voting system's compliance with the Florida Voting System Standards.[2] The Florida Voting Systems Certification program is administered by the Bureau of Voting Systems Certification in the Division of Elections.

[2]Florida Department of State, *Florida Voting System Standards*, Form DS-DE 101 (Jan. 12, 2005).

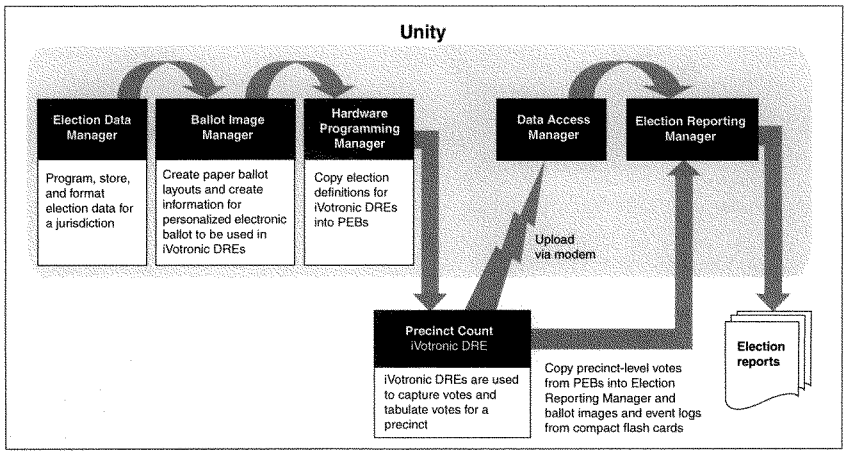
An elected supervisor of elections is responsible for implementing elections in each county in Florida in accordance with Florida election laws and rules. The supervisor of elections is responsible for the purchase and maintenance of the voting systems as well the preparation and use of the voting systems to conduct each election.

Sarasota County Used ES&S Voting Systems in 2006 General Elections

In the 2006 general election, Sarasota County used voting systems manufactured by ES&S. The State of Florida has certified different versions of ES&S voting systems. The version used in Sarasota County was designated ES&S Voting System Release 4.5, Version 2, Revision 2, and consisted of iVotronic DREs, a Model 650 central count optical scan tabulator for absentee ballots, and the Unity election management system. It was certified by the State of Florida on July 17, 2006. The certified system includes different configurations and optional elements, several of which were not used in Sarasota County.

The election management part of the voting system is called Unity; the version that was used was 2.4.4.2. Figure 1 shows the overall election operation using the Unity election management system and the iVotronic DRE.

Figure 1: Overview of Election Operation Using the Unity Election Management System and iVotronic DRE

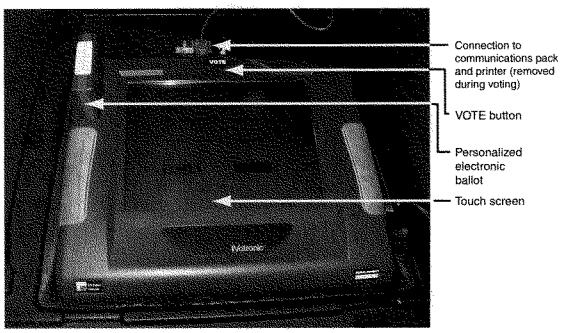


Source: GAO.

Sarasota County used iVotronic DREs for early and election day voting. Specifically, Sarasota County used the 12-inch iVotronic DRE, hardware version 1.1 with firmware version 8.0.1.2.[3] Some of the iVotronic DREs are configured with Americans with Disabilities Act (ADA) functionality, which includes the use of audio ballots. The iVotronic DRE uses a touch screen—a pressure-sensitive graphics display panel—to display and record votes (see fig. 2).

[3]The certified version of ES&S Voting System Release 4.5, Version 2, Revision 2, specifies the use of iVotronic hardware version 1.0. According to Florida Division of Election officials, hardware version 1.1 of the iVotronic DRE has been available since at least 2004 and should have been included as a part of the certification for ES&S Voting System Release 4.5, Version 2, Revision 2. According to ES&S officials, iVotronic firmware version 8.0.1.2 runs in exactly the same manner on hardware versions 1.0 and 1.1.

Figure 2: The iVotronic DRE Voting System and Its Components.



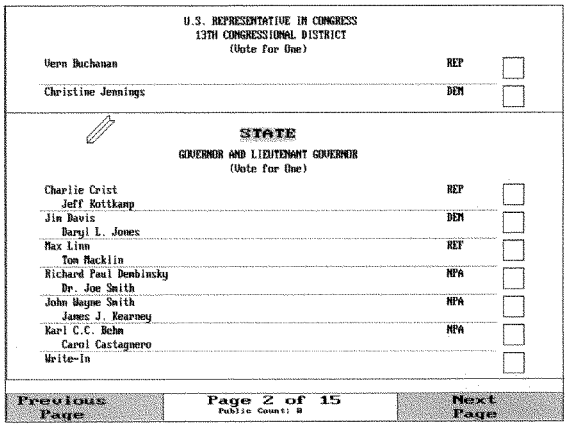
Source: GAO.

The machine has a storage case that also serves as the voting booth. The operation of the iVotronic DRE requires using a personalized electronic ballot (PEB), which is a storage device with an infrared window used for transmission of ballot data to and from the iVotronic DRE. The iVotronic DRE has four independent flash memory modules, one of which contains the program code—firmware—that runs the machine and the remaining three flash memory modules store redundant copies of ballot definitions, machine configuration information, ballots cast by voters, and event logs. The iVotronic DRE includes a VOTE button that the voter has to press to cast a ballot and record the information in the flash memory. The iVotronic DRE also includes a compact flash card that can be used to load sound files onto iVotronic DREs with ADA functionality. The iVotronic DRE's firmware can be updated through the compact flash card. Additionally, at the end of polling, the ballots and audit information are to be copied from the internal flash memory module to the compact flash card.

To use the iVotronic DRE for voting, a poll worker activates the iVotronic DRE by inserting a PEB into the PEB slot after the voter has signed in at the polling place. After the poll worker makes selections so that the appropriate ballot will appear, the PEB is removed and the voter is ready to begin using the system. The ballot is presented to the voter in a series of

display screens, with candidate information on the left side of the screen and selection boxes on the right side (see fig. 3).

Figure 3: Second Ballot Page Showing the Congressional and Gubernatorial Races in Sarasota County's 2006 General Election

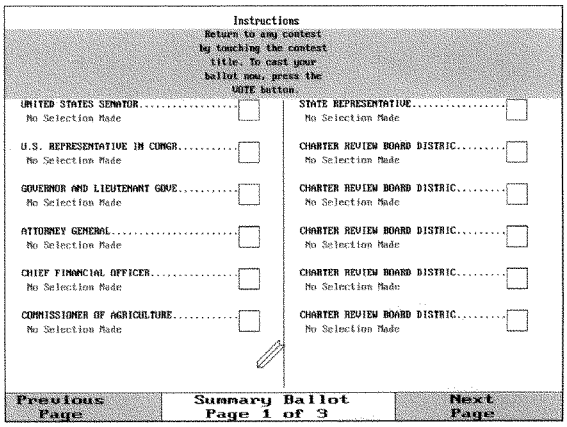


Source: Sarasota County Supervisor of Elections.

The voter can make a selection by touching anywhere on the line, and the iVotronic DRE responds by highlighting the entire line and displaying an X in the box next to the candidate's name. The voter can also change his or her selection by touching the line corresponding to another candidate or by deselecting his or her choice. "Previous Page" and "Next Page" buttons are used to navigate the multipage ballot. After completing all selections, the voter is presented with a summary screen with all of his or her selections (see fig. 4). From the summary screen, the voter can change any selection by selecting the race. The race will be displayed to the voter on its own ballot page. When the voter is satisfied with the selections and has reached the final summary screen, the red VOTE button is illuminated, indicating the voter can now cast his or her ballot. When the VOTE button is pressed, the voting session is complete and the ballot is recorded on the iVotronic DRE. In Sarasota County's 2006 general election, there were nine different ballot styles with between 28 and 40 races, which required

between 15 and 21 electronic ballot pages to display, and 3 to 4 summary pages for review purposes.

Figure 4: First Summary Page in Sarasota County's 2006 General Election



Source: Sarasota County Supervisor of Elections.

Analysis of Election Data Shows that Undervote Was Distributed across All Machines and Precincts

Our analysis of the 2006 general election data from Sarasota County does not identify any particular voting machines or machine characteristics that could have caused the large undervote in Florida's 13th Congressional District race. The undervotes in Sarasota County for the congressional race were generally distributed across all machines and precincts. Using voting system data that we obtained from Sarasota County, we found that 1,499 iVotronic DREs recorded votes in the 2006 general election; 84 iVotronic DREs recorded votes during early voting, and 1,415 iVotronic DREs recorded votes on election day.[4] Using these data, we verified that the vote counts for the contestant, contestee, and undervotes match the reported vote totals for Sarasota County in Florida's 13th Congressional District race. As can be seen in table 2, the undervote rate in early voting was significantly higher than in election day voting.[5]

Table 2: Undervotes in Florida's 13th Congressional District Race during Early and Election Day Voting

	All voters	Early voters	Election day voters
Machines	1,499	84	1,415
Ballots cast	119,919	30,877	89,042
Undervotes	17,846	5,445	12,401
Undervote rate	14.88%	17.63%	13.93%

Source: GAO analysis of Sarasota County data.

The range of the undervote rate for all machines was between 0 and 49 percent, with an average undervote rate of 14.3 percent. When just the early voting machines are considered, the undervote rate ranged between 5 and 28 percent. The largest number of undervotes cast on any one machine on election day was 39. While the range of ballots cast on any one machine on election day was between 1 and 121, the median number of

[4]Election day voting is the casting of ballots on election day at polling places. Absentee and early voting are programs that permit eligible persons to vote prior to election day. Absentee voting is conducted by mail in advance of election day and early voting is generally in-person voting in advance of election day at specific polling locations.

[5]Early and election day ballots include provisional ballots cast during those respective stages of voting and included in the vote totals. 160 provisional ballots were included in the vote totals. 37 provisional ballots were excluded.

Because the absentee ballots were not cast using iVotronic voting systems, we did not verify the absentee ballot counts. When absentee ballots are included, a total of 142,532 ballots were cast and a total of 18,412 undervotes were recorded.

ballots cast on any one machine was 66. The range of undervote rate by precinct was between 0 and 41 percent, and the average undervote by precinct was about 14.8 percent.

Prior Tests and Reviews Provide Some Assurance, but Do Not Provide Reasonable Assurance That the iVotronic DREs Did Not Contribute to the Undervote

Prior to the elections, Sarasota County's voting systems were subjected to several different tests that included testing by the manufacturer, certification testing by the Florida Division of Elections, testing by independent testing authorities, and logic and accuracy testing by Sarasota County's Supervisor of Elections. After the 2006 general election, an audit of Sarasota County's election was conducted by the State of Florida that included a review of the iVotronic source code, parallel tests, and an examination of Sarasota County's election procedures. Although these tests and reviews provide some assurance, as do certain controls that were in place during the election, that the voting systems in Sarasota County functioned correctly, they do not provide reasonable assurance that the iVotronic DREs did not contribute to the undervote.

Prior Tests and Reviews of Sarasota County's Voting Systems Provide Useful Information, but Have Some Shortcomings

According to ES&S officials, ES&S tested the version of the iVotronic DRE that was used in Sarasota County in 2001-2002, but they could not provide us documentation for those tests because the documentation had not been retained.

The Florida Division of Elections conducted certification testing of the iVotronic DRE and the Unity election management system before Sarasota County acquired the system from the manufacturer. The certification process included tests of the election management system and the conduct of mock primary and general elections on the entire voting system. ES&S Voting System, Release 4.5, Version 2, Revision 2, was certified by the Florida Division of Elections on July 17, 2006. According to Florida Division of Elections officials, testing of each version focuses on the new components, and components that were included in prior versions are not as vigorously tested. The 8.0.1.2 version of the iVotronic firmware was first tested as a part of ES&S Release 4.5, Version 1, which was certified in 2005. Version 2 introduced version 2.4.4.2 of the Unity Election Management System, which was certified in August 2005. Certification testing was conducted on software that was received from an independent test authority, who witnessed the building of the firmware from the source code. An independent test authority also conducted environmental testing

of the iVotronic DRE in 2001 that was relied upon by the Florida Division of Elections for certification.

A logic and accuracy test was conducted by Sarasota County on October 20, 2006, on 32 iVotronic DREs, and it successfully verified that all ballot positions on all nine ballot styles could be properly recorded. In addition, the use of a provisional ballot and audio ballot were tested, as well as machines configured for early voting with all nine ballot styles.

After the 2006 general election, the Florida Division of Elections conducted an audit of Sarasota County's 2006 general election that included two parallel tests, an examination of the certified voting system and conduct of election by Sarasota County's elections office, and an independent review of the iVotronic DRE firmware's source code. After the conduct of this audit, the audit team concluded that there was no evidence that suggested the official election results were in error or that the voting systems contributed to the undervote in Sarasota County.[6] The parallel tests were performed using 10 iVotronic DREs—5 used in the 2006 general election and 5 that were not used. Four of the machines in each test replicated the votes cast on four election day iVotronic DREs. The fifth machine in each test used an ad hoc test script that involved picking a random vote pattern along with a specific vote selection pattern picked from 10 predetermined vote patterns for the 13th Congressional District for each ballot cast. The audit report asserts that testing a total of 10 machines is more than adequate to identify any machine problems or irregularities that could have contributed to undervotes in the Florida-13 race. However, we concluded that the results from the testing of 10 machines cannot be applied to all 1,499 iVotronic DREs used during the 2006 general election because the sample was not random and the sample size was too small.

In examining whether voting systems that were used in Sarasota County matched the systems that were certified by the Florida Division of Elections, the Florida audit team examined the Unity election management system and the firmware installed on six iVotronic DREs. The audit team confirmed that the software running on the Unity election management

[6]Florida Department of State, *Audit Report of the Election Systems and Software, Inc.'s, iVotronic Voting System in the 2006 General Election for Sarasota County, Florida* (Tallahassee, Florida: Feb. 2007), and Security and Assurance in Information Technology Laboratory, Florida State University, *Software Review and Security Analysis of the ES&S iVotronic 8.0.1.2 Voting Machine Firmware* (Tallahassee, Florida: Feb. 23, 2007).

system and the firmware in the six iVotronic DREs matched the certified versions held in escrow by the Florida Division of Elections. On the basis of its review, the audit team concluded that there is no evidence to indicate that the iVotronic DREs had been compromised or changed. We agree that the test verifies that those six machines were not changed, but any extrapolation beyond this cannot be statistically justified because the size of the sample is too small. Therefore, these tests cannot be used to obtain reasonable assurance that the 1,499 machines used in the general election used the certified firmware.

A software review and security analysis of the iVotronic firmware version 8.0.1.2 was conducted by a team led by Florida State University's SAIT Laboratory. The eight experts in the software review team attempted to confirm or refute many different hypotheses that, if true, might explain the undervote in the race for the 13th Congressional District. In doing so, they made several observations about the code, which we were able to independently verify. The software review and our verification of the observations were helpful, but a key shortcoming was the lack of assurance whether the source code reviewed by the SAIT team or by us, if compiled, would correspond to the iVotronic firmware that was used in Sarasota County for the 2006 election. According to ES&S and Florida Division of Elections officials, in May 2005 an independent testing authority witnessed the process of compiling the source code and building the version of firmware that was eventually certified by the Florida Division of Elections. According to ES&S officials, if necessary, ES&S can recreate the firmware from the source code, but the firmware would not be exactly identical to the firmware certified by the Florida Division of Elections because the embedded date and time stamp in the firmware would be different.

The software review team also looked for security vulnerabilities in software that could have been exploited to cause the undervote. Although the team found several software vulnerabilities, the team concluded that none of them were exploited in Sarasota in a way that would have contributed to the undervote. We did not independently verify the team's conclusion.

Reasonable Assurance of Some Voting System Objectives Has Been Achieved

The Unity election management system and the iVotronic DREs are the major voting system components that may require testing to determine whether they contributed to the large undervote in Sarasota County. Our review of tests already conducted and documentation from the election provide us reasonable assurance that the key functions of the Unity

election management system—election definition and vote tabulation—did not contribute to the undervote. The election definitions created using the Unity election management system are tested during logic and accuracy testing to demonstrate that they include all races, candidates, and issues and that each of the items can be selected by a voter. The votes tabulated on the iVotronic DRE at each precinct matched the data uploaded to the Unity election management system, and the totals from the precinct results tapes agree with that obtained by Unity. Further, the state audit confirmed that the Unity election management system software running in Sarasota County matched the escrowed version certified by the Florida Division of Elections.

We have reasonable assurance that the number of ballots recorded by the iVotronic DREs is correct because this number is very close to the number of people recorded on the precinct registers as showing up at the polling places to vote either during early voting or on election day. This assurance also allows us to conclude that issues, such as votes cast by "fleeing voters"—votes that are cast by poll workers for voters who leave the polling place before pressing the button to cast the vote—and the potential loss of votes during a system shutdown, did not affect the undervote in this election. If these issues had occurred, they would have caused a discrepancy between the number of voters who sign in at the polling place to vote and the public counts recorded on the iVotronic DREs.

We have reasonable assurance that provisional ballots were appropriately handled by the iVotronic DREs and the Unity election management system. We also verified that during the Florida certification test process, the Division of Elections relied on successful environmental and shock testing conducted by an independent test authority.

Reasonable Assurance That All iVotronic DREs Used in the 2006 General Election Used Software Certified by the Florida Division of Elections Is Lacking

We found that prior testing and activities do not provide reasonable assurance that all iVotronic DREs used in Sarasota County on election day were using the hardware and firmware certified for use by the Florida Division of Elections. Sarasota County has records indicating that only certified versions were procured from ES&S, and the firmware version is checked in an election on the zero and results tapes. However, because there was no independent validation of the system versions, we cannot conclude that no modifications were made to the systems that would have likely made them inconsistent with the certified version. As we previously mentioned, the firmware comparison of only 6 iVotronic DREs in the state audit is insufficient to support generalization to all 1,499 iVotronic DREs that recorded votes during the election. Without reasonable assurance that

all iVotronic DREs are running the same certified firmware, it is difficult for us to rely on the results of other testing that has been conducted, such as the parallel tests or the logic and accuracy tests.

The Ability of Voters to Make Selections in Different Ways and Have Their Votes Properly Recorded Has Not Been Fully Tested

Prior testing of the iVotronic DREs only verified 13 of the 112 ways that we identified that a voter may use to select a candidate in Florida's 13th Congressional District race. Specifically, on an iVotronic DRE, a voter could (1) initially select either candidate or neither candidate (i.e. undervote), (2) change the vote on the initial screen, and (3) use a combination of page back and review screen options to change or verify his or her selection before casting the ballot. By taking into account these variations, our analysis has found at least 112 different ways a voter could make his or her selection in Florida's 13th Congressional District race, assuming that it was the only race on the ballot. Out of 112 different ways to select a candidate in the congressional race, Florida certification tests and the Sarasota County logic and accuracy tests verified 3 ways to select a candidate; and the Florida parallel tests verified 10 ways to select a candidate—meaning that of the 112 ways, 13 have been tested. By not verifying these different ways to select a candidate, we do not have reasonable assurance that the system will properly handle expected forms of voter behavior.

The Effect of Miscalibrated iVotronic DREs Is Unclear

During the setup of the iVotronic DRE, sometimes referred to as the clear and test process, the touch screens are calibrated by using a stylus to touch the screen at 20 different locations. The calibration process is designed to align the display screen with the touch screen input. It has been reported that a miscalibrated machine could affect the selection process by highlighting a candidate that is not aligned with what the voter selected. We identified two reported cases on election day where the miscalibration of the iVotronic DRE led to its closure and discontinued use for the rest of the day. While a miscalibrated machine could certainly make an iVotronic DRE harder to use, it is not clear it would have helped to contribute to the undervote. We did not identify any prior testing or activities that would help us understand the effect of a miscalibrated iVotronic DRE on the undervote.

Further Tests Could Provide Increased but Not Absolute Assurance That the iVotronic DREs Used in the Election Did Not Cause the Undervote

On the basis of our analysis of all prior test and audit activities, we propose that a firmware verification test, a ballot test, and a calibration test be conducted to try to obtain increased assurance that the iVotronic DREs used in Sarasota County during the 2006 general election did not cause the undervote.

We propose that the firmware verification testing be started first, once the necessary arrangements have been made, such as access to the needed machines and the development of test protocols and detailed test procedures. Once we have reasonable assurance that the iVotronic DREs are running the same certified firmware, we could conduct the ballot test and calibration test on a small number of machines to determine whether it is likely the machines accurately recorded and counted the ballots. If the firmware verification tests are successfully conducted, we would have much more confidence that the iVotronic DREs will behave similarly when tested. If there are differences in the firmware running on the iVotronic DREs, we would need to reassess the number of machines that need to be tested for ballot testing and calibration testing in order for us to have confidence that the test results would be true for all 1,499 iVotronic DREs used during the election. In other words, if we are reasonably confident that the same software is used in all 1,499 machines, then we are more confident that the results of the other tests on a small number of machines can be used to obtain increased assurance that the iVotronic DREs did not cause the undervote. Although the proposed tests would provide increased assurance, they would not conclusively eliminate the machines as a cause of the undervote.

Conduct Firmware Testing to Verify That the Firmware in the iVotronic DREs Used in Sarasota County Matches the Certified Version

We propose to conduct a firmware verification test using a statistical sampling approach that can provide reasonable assurance that all 1,499 iVotronic DREs are running the certified version of firmware. The exact number of machines that would be tested depends on the confidence level desired and how much error can be tolerated. We propose drawing a representative sample from all the iVotronic DREs that recorded votes in the general election. With a sample size of 115 iVotronic DREs, which would be divided between sequestered and nonsequestered machines, and assuming that there are no test failures, we would be able to conclude with a 99 percent confidence level that no more than 4 percent of the 1,499 iVotronic DREs used in the election were using uncertified firmware.

We suggest a test approach similar to what was used by the Florida Division of Elections when it verified the firmware for 6 iVotronic DREs.

We estimate that the firmware testing for 115 machines could be conducted in about 5 to 7 days and would require about 5 or 6 people, once the necessary arrangements have been made. The machines would be transported to a test facility specified by Sarasota County election officials where we could perform the test. The activities involved in conducting a firmware validation test would include locating and retrieving the selected iVotronic DRE from the storage facility, transporting it to the test facility, opening the DRE, extracting the chip with the firmware, reading the contents of the chip using a specialized chip reader, and conducting a comparison between the contents and the certified firmware to determine if any differences exist. To conduct this test, we would need commercially available specialized hardware and software similar to that used by the Florida Division of Elections in its firmware comparison test.

Conduct Ballot Testing of iVotronic DREs to Confirm Correct Operation

We propose conducting ballot testing on 10 iVotronic DREs, each configured with one of the nine different ballot styles, with the 10th machine configured as an early voting machine with all nine ballot styles. We would test 112 ways to select a candidate on the early voting machine. On the election day machines, we would test the 112 different ways distributed across the 9 machines in a random manner, meaning each machine would on average record 12-13 ballots. Assuming that (1) reasonable assurance is obtained that all iVotronic DREs used during the election were using the same certified firmware, and (2) we found no failures during the ballot testing, this testing would provide increased assurance that the iVotronic DREs used during the election, both in early voting and in election day voting, were able to accurately record and count ballots when using any of the 112 ways to select a candidate in the Florida-13 race.

We would plan to code each ballot by including an identifier in the write-in candidate field for either the U.S. senator or governor's race. Using this write-in coding, we could examine the ballot image and confirm that each ballot was accurately recorded and counted by the iVotronic DRE. Any encountered failures would also be more rapidly attributed to a specific test case, and we would be able to more readily repeat the test case to determine if we have a repeatable condition. Testing 112 ways to select a candidate on a single machine would also provide us some additional assurance that the volume of ballots cast on election day did not cause a problem. We note that casting 112 ballots on a single machine is more than that cast on over 99 percent of the 1,415 machines used on election day.

We estimate the ballot testing would take about 2 to 3 days and require the equivalent of 2 people, once the necessary arrangements have been made.

Deliberately Miscalibrate an iVotronic DRE to Understand the Effect on the Undervote

Because little is known about the effect of a miscalibrated machine on the behavior of an iVotronic DRE, we propose to deliberately miscalibrate an iVotronic DREs and verify the functioning of the machine. We propose to identify different ways to miscalibrate a ballot and to test ballots on the miscalibrated iVotronic DRE to verify that it still properly records votes. With this test we would confirm whether (1) the review screen displays the same selection in the Florida-13 race as was highlighted in the selection screen, and (2) that the vote is recorded as it was displayed on the review screen. Again, we would plan to use the write-in candidate option to verify the proper recording of the ballot. This test would demonstrate whether the system correctly records a vote for the race and hence whether it contributed to the undervote. We estimate that the calibration test could be completed in about 1 day by 2 people, once the necessary arrangements have been made.

Several Matters Remain to Be Addressed to Conduct Further Testing

Should the task force ask us to conduct the proposed testing, we want to make the task force aware of several other matters that would need to be addressed before we could begin testing. These activities would require some time and resources to complete before testing could commence.

First, we would need to gain access to iVotronic DREs that have been subject to a sequestration order in the state court system of Florida. If we do not have access to the needed machines, we would be unable to obtain reasonable assurance that the machines used on election day were using certified software, and without this assurance, the results from prior tests and any results of our ballot and calibration tests would be less meaningful because we would be unable to apply the results to all 1,499 iVotronic DREs used during the election. Second, we would need to agree upon an appropriate facility for the tests. Sarasota County Supervisor of Elections has indicated that we can use its warehouse space, but because of upcoming elections in November and January, the only time the election officials would be able to provide us this space and the necessary support is between November 26 and December 7, 2007. If testing cannot be completed during this time period, Sarasota County officials stated that they would not be able to assist us until February 2008. Third, some tests may require commercially available specialized software, hardware, or other tools to conduct the tests. We would need to make arrangements to either borrow or to purchase such testing tools before

commencing testing. Fourth, in order to conduct any tests, we would need to develop test protocols and detailed test procedures and steps. We also anticipate that we would need to conduct a dry run, or dress rehearsal, of our test procedures to ensure that our test tools function properly and that our time estimates are reasonable. Finally, we would need to make arrangements for video recording of our testing. It would be our preference to have a visual record of the tests to document the actual test conduct and to facilitate certain types of test analysis.

Other Observations on Touch Screen Voting Systems

We recognize that human interaction with the ballot layout could be a potential cause of the undervote. Although we have not explored this issue in our review, we note that there is an ongoing academic study that is exploring this issue using voting machines obtained from ES&S. We believe that such experiments could be useful and could provide insight into the ballot layout issue.

During our review, we noted that several suggestions have been offered as possible ways to establish that voters are intentionally undervoting and to provide some assurance that the voting systems did not cause the undervote. First, a voter-verified paper trail could provide an independent confirmation that the touch screen voting systems did not malfunction in recording and counting the votes from the election. The paper trail would reflect the voter's selections and, if necessary, could be used in the counting or recounting of votes. This issue is recognized in the Florida State University SAIT source code review as well as the 2005 and draft 2007 Voluntary Voting Systems Guidelines prepared for the Election Assistance Commission. We have previously reported on the need to implement such a function properly.[7] Second, explicit feedback to voters that a race has been undervoted and a prompt for voters to affirm their intent to undervote might help prevent many voters from unintentionally undervoting a race. On the iVotronic DREs, such feedback and prompts are provided only when the voter attempts to cast a completely blank ballot, but not when a voter undervotes in individual races. Third, offering a "none of the above" option in a race would provide voters with the opportunity to indicate that they are intentionally undervoting. The State of Nevada provides this option in certain races in its elections. Decisions

[7]GAO, *Elections: Federal Efforts to Improve Security and Reliability of Electronic Voting Systems Are Under Way, but Key Activities Need to Be Completed*, GAO-05-956 (Washington, D.C.: Sept. 21, 2005).

about these or other suggestions about ballot layout or voting system functions should be informed by human factors studies that assess their effectiveness in accurately recording voters' preferences, making voting systems easier to use, and preventing unintentional undervotes.

Conclusions

The high undervote encountered in Sarasota County in the 2006 election for Florida's 13th Congressional District has raised questions about whether the voting systems accurately recorded and counted the votes cast by eligible voters. Other possible reasons for the undervote could be that voters intentionally undervoted or voters did not properly cast their ballots on the voting systems, potentially because of issues relating to the interaction between voters and the ballot. The focus of our review has been to determine whether the voting systems—the iVotronic DREs, in particular—contributed to the undervote. We found that the prior reviews of Sarasota County's 2006 general election have provided valuable information about the voting systems. Our review found that in some cases we were able to rely on this information to eliminate areas of concern. This allowed us to identify the areas where increased assurances were needed to answer the questions being raised. Accordingly, the primary focus of the tests we are proposing is to obtain increased assurance that the results of the prior reviews and our proposed testing can be applied to all the iVotronic DREs used in the election. Our proposed tests involving the firmware comparison, ballot testing, and calibration testing could help reduce the possibility that the undervote was caused by the iVotronic DREs. However, even after completing the tests, we would not have absolute assurance that the iVotronic DREs did not play any role in the large undervote. Absolute assurance is impossible to achieve because we are unable to recreate the conditions of the election in which the undervote occurred. By successfully conducting the proposed tests, we could reduce the possibility that the iVotronic DREs were the cause of the undervote and shift attention to the possibilities that the undervote was the result of intentional actions by the voter or voters that did not properly cast their votes on the voting system.

Comments and Our Evaluation

We provided draft copies of this statement to the Secretary of State of Florida, the Supervisor of Elections of Sarasota County, and ES&S for review and comment. The Florida Department of State provided technical comments, which we incorporated. The Sarasota County Supervisor of Elections appreciated the opportunity to review the draft, but provided us no comments.

In its comments, ES&S stated that it believes that the collective results of testing already conducted on the Sarasota County voting systems have demonstrated that they performed properly and as they were designed to function and that all votes were accurately captured and counted as cast in Florida's 13th Congressional District race. Further, ES&S asserts that tests and analyses should be conducted to examine the effect of the ballot display on the undervote, which it believes is the most probable cause of the undervote.

We disagree that the collective results of testing already conducted on the Sarasota County voting systems adequately demonstrate that the voting systems could not have contributed to the undervote in the Florida-13 race. First, as we have cited, we do not have adequate assurance that all the iVotronic DREs used in Sarasota County used the firmware certified by the Florida Division of Elections. Without this assurance, it is difficult for us to apply the results from the other tests to all 1,499 machines that recorded votes during the election because we are uncertain that all machines would have behaved in a similar manner. Further, we believe that expected forms of voter behavior to select a candidate in the Florida-13 race were not thoroughly tested. While ES&S asserts that such processes would have no effect on the iVotronic DRE's ability to capture and record a voter's selection, we did not identify testing that verified this. Further, while ES&S states that the testing of a deliberately miscalibrated iVotronic DRE would result in a clearly visible indication of which candidate was selected, we could not identify any testing that demonstrated this.

We acknowledge that the large undervote in Florida's 13th Congressional District race could have been caused by voters who intentionally undervoted or voters who did not properly cast their ballots, potentially because of issues related to the human interaction with the ballot. However, the focus of our review, as agreed with the task force, was to review whether the voting systems could have contributed to the large undervote. ES&S also provided technical comments, which we incorporated as appropriate.

Mr. Chairman, this completes my prepared statement. I would be happy to respond to any questions you or other members of the task force may have at this time.

Contacts and Acknowledgments

For further information about this statement, please contact Keith Rhodes, Chief Technologist, at (202) 512-6412 or rhodesk@gao.gov, or Naba Barkakati at (202) 512-4499 or barkakatin@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. Other key contributors to this statement include James Ashley, James Fields, Jason Fong, Cynthia Grant, Geoffrey Hamilton, Richard Hung, John C. Martin, Jan Montgomery, Jennifer Popovic, Sidney Schwartz, and Daniel Wexler.

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Mr. GONZALEZ. Thank you very much, Doctor.

I have been informed that Congresswoman Lofgren may not be able to make it back before the recorded votes. It would be my intention, then, that we would be recessing once we are called for votes if we still have business going on and then reconvening. I apologize. But Zoe's—obviously, there are other pieces of legislation. She is meeting with leadership, and she is actually with the Speaker, as we speak.

But a couple things, Doctor, let me ask you on some of the things that are kind of, you know, reasonably understandable by the lay person.

You are going to be conducting tests on a greater number of machines than were used in the previous testing. Is that correct?

Mr. BARKAKATI. Yes. I didn't mention specifically, but the number always depends on the level of confidence they want and the error you are going to tolerate.

And if you want to conclude at a 99 percent confidence level that, at the most, 4 percent of the machines may have different software, then you have to test 115, according to our statisticians, you have to test 115 machines, which would be selected out of the ones that are sequestered as well as the ones that have been used since the 2006 election. And that is what we are proposing, 115 machines to test.

Mr. GONZALEZ. As opposed to how many that were tested previously?

Mr. BARKAKATI. There were six machines that were tested in Florida State's audit. And that was the point that statisticians made, that it was an insufficient number to conclude that the results could apply to all the machines.

Mr. GONZALEZ. The other thing you pointed out was also the different options or variations that could actually occur in voting in the Florida–13. I believe that there are over 100 variations; is that correct?

Mr. BARKAKATI. Yes. The reason for looking through all the variations is that we are trying to use the machine's features in determining how many ways you could go back and change your vote and, you know, maybe confirm what you have done and then vote. Because of the ways you can do so, by paging back, because there are multiple pages of ballots, and you can go from the review screen where you see the summary and can touch and go back—because of those combinations, it comes out to be 112 for a simple, like, 2-person race, where you are having to consider many different ways of going back and forth. And that is the reason we have 112 ways we determined that we should be testing.

Mr. GONZALEZ. And you are going to use how many variations?

Mr. BARKAKATI. We are going to use all those 112 ways of selecting a candidate and casting a ballot.

Mr. GONZALEZ. And how many were used in the testing?

Mr. BARKAKATI. In the previous tests, we had 10 ways of combinations that were used in the Florida State audit. And then the normal testing of candidates verifies three ways, which is like each candidate and an undervote. So those three ways were covered. So 13 ways were covered by previous tests.

But I should emphasize that we are not putting as much—that is not the biggest item. More important to ask was the confirmation of the firmware, that every machine is running the same software. That was the important part. And then this is another additional assurance to confirm the proper working of the machine.

Mr. GONZALEZ. Okay.

And I wish to acknowledge that we have been joined by Congressman Ehlers, who is the ranking member of the full committee.

Welcome, Congressman.

The other thing that was of concern and I think we have touched on in the past—of course, time is always of the essence when we have these contests. I think we all agree on that. But we wanted to do this in a very orderly manner. It is somewhat disturbing that we would not be able to actually conclude some of this testing until late November, early December.

My understanding is the reason that we would do that is that is the only time that the Florida officials would be available to assist you. To try to do it any other way actually may even prolong it. In other words, if we assume responsibility for the premises, the security of the premises, the sequestered machines, rather than the present situation where everybody in Florida is duly acknowledged and authorized to maintain that kind of control, to do it any other way would probably even extend it beyond November 26 through the first week of December.

Is that correct?

Mr. BARKAKATI. That is true. We had considered based on the task force's need for doing it faster, and we also concluded that it would be hard to get it done any other way because of all the reasons that you cited. And what they had told us is that if we cannot do it within that 2-week time period, then it could be as late as in February because of other primaries coming up for the presidential election.

Mr. GONZALEZ. Okay. So we are faced with the situation that November 26 may be the earliest. And that is a window of opportunity. And I will tell you now that we need to take advantage of that opportunity and in no way wait until 2008.

At this time, I will recognize my colleague, Congressman McCarthy.

Mr. MCCARTHY. Well, thank you, Mr. Chairman. I just ask that we could keep this ratio in the full committee as well. [Laughter.]

Let me just touch on a few—and I appreciate the help. Now, you have looked at the reports that Sarasota, the reports that Florida has done, and the reports of the experts. Have you found anything in those reports in your testing that doesn't conclude what they have said?

Mr. BARKAKATI. No, we didn't find anything—we didn't find anything that concluded anything different from what they have already concluded.

Mr. MCCARTHY. Okay. And if I understand correctly, you have some assurance already, and to take it to 99 percent assurance would take 115 machines?

Mr. BARKAKATI. Yes.

Mr. MCCARTHY. And of those machines that you tested, were all those machines used in the election?

Mr. BARKAKATI. Oh, no, I am sorry. We have not tested any machines yet. What we are proposing is that we would test 115 machines.

Mr. MCCARTHY. I thought you said six machines were tested.

Mr. BARKAKATI. Oh, I am sorry. Yeah, you are right. Those six machines were tested by Florida State during their audit.

Mr. MCCARTHY. And those were used in the election?

Mr. BARKAKATI. They were. Those six machines were—I think they were used in the election maybe——

Mr. MCCARTHY. And in the precinct?

Mr. BARKAKATI. I don't know precisely. At least some of them were used.

Mr. MCCARTHY. It is my understanding those six were used in this congressional election in those precincts. And you found nothing wrong with these?

Mr. BARKAKATI. No. Those tests didn't find anything wrong.

Mr. MCCARTHY. All right. So if the 115 machines give you 99 percent assurance, where are you currently in your assurance of nothing going wrong?

Mr. BARKAKATI. The statisticians, I mean, we didn't ask them to calculate it with the six machines tested. That is going to be pretty low, though, you know, in terms of statistical terms, it will be very low assurance that all the population of machines are running the same software.

Mr. MCCARTHY. So you just want to have that reasonable assurance?

Mr. BARKAKATI. Right. I mean, we wanted——

Mr. MCCARTHY. You wanted to be at absolute?

Mr. BARKAKATI. Yes. We could probably get back to you with the number. But that would be, honestly speaking, quite low, I mean, in the tens or less probably. But for 99 percent assurance that all the machines are running—see, we are kind of running into the situation that we don't know if all the machines are the same or not, even though there is no reason to say they are not the same.

Mr. MCCARTHY. Of this that you have already tested, has there been any smoking gun or any signs that would drive you to look at something else?

Mr. BARKAKATI. No.

Mr. MCCARTHY. Okay. So you have some assurance already. The ballot design, does that move up on the list of maybe the outcome of what has caused this?

Mr. BARKAKATI. Actually, we were trying to say it in this manner. If we did the tests of the 115 machines and there was nothing found in the ones we are proposing, then definitely the remaining next cause, only remaining cause would be—after all, voters can intentionally do it. That is a different issue. Then unintentionally missing it because of ballot layout is the prominent reason, probably, remaining at that point.

Mr. MCCARTHY. Well, I keep seeing, with the testing that we have done, the county did the testing, the State did the testing, brought in the independents, and now you have done so much that you come back all with the same answer, the assurance. And then we are going to go one more.

Just for the voters of the 13th, so far everything that was said on Election Day has come true. Would this be the end of this? Would we be able to tell the voters then—I guess right now we can tell them we have reasonable assurance that, yes, the outcome is true—that we would be able to say, yes, the outcome is totally true.

Mr. BARKAKATI. I think, actually, after we finish the tests we proposed, then we can say that we have a reasonable assurance that the machines did not probably cause the undervote. At that point, we can make the statement, because then we have tested it. Right now, our problem is that we—basically, the sticking point is that we don't know if all the machines are truly——

Mr. MCCARTHY. We want to get to the highest percentage so we can say we are at 99 percent. We can never get to 100. But we just want to reaffirm what we already found out from our testing.

Mr. BARKAKATI. Yes. To be able to apply the results we know so far, which have been showing that the machine hasn't caused anything.

Mr. MCCARTHY. So we just want to jump through the next hoop to reassure what we already know.

Mr. BARKAKATI. The problem we are running into—the statisticians tell us that, with the six machines tested, I could not say that we have reasonable assurance yet. We are getting that after we have finished the 115 machines. Then we can say that all the tests that were done so far tell us now that we are very much certain that they are——

Mr. MCCARTHY. Well, I believe, Mr. Chairman, that I would support to do this further testing. But I would like to come to a conclusion. And I know we have an assurance so far. And I will go to the 99 percent, but I don't want to carry it on 2 years until the next election.

I yield back.

Mr. GONZALEZ. Thank you very much, Mr. McCarthy. I know there is only a certain degree of, again, certainty that we can arrive at. But I understand what you are saying.

At this time, does anyone else wish to be recognized?

Mr. Lungren.

Mr. LUNGREN. Thank you very much, Mr. Chairman.

You may have already answered this, but let me just get this correct. If you do the test that you are asking the task force to permit you to do, you can then come back with your results and say that you have reached a reasonable assurance that either the machines did malfunction or did not malfunction?

Mr. BARKAKATI. Yes. We will be able to say it at that point.

Mr. LUNGREN. Okay. If you say that, is there a possibility you would ask for further tests?

Mr. BARKAKATI. No. I mean, we have——

Mr. LUNGREN. Okay.

Mr. BARKAKATI. We can never say that we considered all possible tests by the machine.

Mr. LUNGREN. I understand that. But I just want to make sure that, from your standpoint, you are telling us if the task force okays the testing, when you finish that, you will be able to give us what you call a, quote/unquote, "reasonable assurance" level conclusions?

Mr. BARKAKATI. Yes.

Mr. LUNGREN. Okay. Now, here is the question I got. On page 15 of the draft that we had received, you explain the justification for one of the three additional tests you are proposing, which expanded the number of ways a voter could select the candidate in the congressional race from the 13 tests to the 112.

Now, see if I have got this right. To get to the 112 ways a voter could choose a candidate, it appears the voters would have to cast and change their votes in this race four times. Now, just to an average person or even someone who has been involved in politics a long time, both as a candidate and as a voter, changing your vote in a single race four times would seem highly unusual, to say the least. But your report says that the 112 permutations would compile the expected forms of voter behavior.

What I am trying to understand is, how is that within the universe of the expected forms of voter behavior? I would call that aberrate behavior, unusual behavior, something that, if I saw it, would either send up a red flag or I would say, "That is so unusual, I wouldn't expect to see it again."

Mr. BARKAKATI. Actually, I should say that those 112 include all the combinations. Of course, one person doing—I mean, there are some that are like—we have eliminated some that wouldn't make any sense.

Mr. LUNGREN. I am trying to understand. Am I reading it correctly? Is that what the report said? You would have to change your vote in this race four times to come to that——

Mr. BARKAKATI. The combinations include everything from single, one selection to changing once to other combinations of changing, going forward, coming back and changing. So it is a combination of all of them coming out to be 112.

To get to the 112, you do include some what might seem like odd behavior. But the counts come up because it includes everything from simple to complicated ones.

And the assumption is, if you did not know anything about the machine, then you are trying to make it do all the stuff that it can do, to confirm that it works under all those circumstances. And that was the reason for picking that.

I mean, in some ways, because you have to realize that 112 ballots can be cast within about 1 day basically, so we thought that is a good test to exercise the machine.

Mr. LUNGREN. Sure. You are making sure you take the whole universe in of possible voter behavior, it would seem to me, rather than just expected forms.

Let me ask you this, and I didn't quite understand what you were saying about, you call it, ballot layout. I have heard the expression, "ballot design." Nothing you are doing goes to the question of ballot design or ballot layout, is that correct, in your tests?

Mr. BARKAKATI. I should qualify it in this way. The machine that we are testing is loaded with the ballot that was used in the 2006 election. So in that sense, it has the layout that is there. We are testing that.

But the human interaction, the voters' reaction to the ballot, is not something we have tested or have proposed right now. And

which is why we kind of ended up saying that, if we do this, the machine could be eliminated as the reason, but——

Mr. LUNGREN. Machines would be eliminated.

Mr. BARKAKATI. Yeah, but the voters——

Mr. LUNGREN. Okay. I just wanted to make sure that is what you were talking about. Thank you very much.

Thank you, Mr. Chairman.

Mr. GONZALEZ. You are welcome.

Mr. Ehlers, do you have any questions?

Mr. EHLERS. Thank you, Mr. Chairman. Just a few.

As a scientist, I am a little worried about the terms used here: partial assurance, absolute assurance, increased assurance and so forth.

When you have concluded the next set of tests, will you be able to express that in terms of a percentage likelihood, rather than the nondescriptive terms or nonquantitative terms you used?

Mr. BARKAKATI. Yeah, I think we will be able to do the statistical sample of the machine in the primary comparison. That part we can definitely do in a quantifiable way.

And as far as our statisticians, the next part depends on the logic, which says that machines that run the same software would behave the same way. If you accept that logic, then we can extend it to that level, that, yes, that will be quantifiable.

And if it is not quantifiable, what we are saying is that our reasonable assurance is that machines do not cause—you know, it is not 100 percent, but with some very high degree of certainty, the machine did not cause the problem. That would be our——

Mr. EHLERS. Well, you talk about your assurance now. What would you guess is your percentage assurance now that——

Mr. BARKAKATI. I should really not probably guess because—I should have asked our statisticians to calculate that. They would be able to tell with the sample of six what the percentage would be. Unfortunately I shouldn't say. I mean, I know it is low because they said, "Oh, that is not good enough." But I wouldn't quantify it. At this point, I don't know statistically.

Mr. EHLERS. What concerns me a little is we keep going by iteration, and we may end up with a 99 percent assurance. Are you going to come back and say, "Well, we should do a few more tests and maybe we can get it at 99.5"? Where are you going to draw the line?

Mr. BARKAKATI. Actually, we did pick the 99 percent confidence level based on the sample size we could test in a reasonable amount of time. And even though we are cautious in how we present our results and everything in a very careful way, we do expect that that will give us what we might call reasonable assurance.

And like I said, at that point, we can say that no more than 4 percent of the machines could have had any problem, you know, essentially. That only gives you an error level of 4 percent, unfortunately. That is how it goes.

Mr. EHLERS. Okay. But our decision here is basically whether Mr. Buchanan remains seated as the Congressman or he does not. And you have to have—the evidence for saying that he is not has to be very, very strong. In other words, you may be talking about

a 99 percent assurance that the machines worked right, but if you are trying to show the other—or anyone is trying to show that he should not be seated, that Ms. Jennings had won, there has to be a very high probability in her favor.

What I am getting at is it appears, what you have so far, there is no probability that, given the evidence you have—or very low probability that she was the actual winner. And it is a much higher probability that he is the winner. Is that correct?

Mr. BARKAKATI. I think after we finish our proposed testing, that will be certainly the indication, that the machines were—I mean, if your decision is based on the machines' performance, whether it is working or not working, it is most likely that everything succeeds, then we conclude the machines were not the problem. And then it will be up to the task force to decide how to use that knowledge, I think.

Mr. EHLERS. Okay. Then we get into issues of ballot design, human behavior and so forth.

Mr. BARKAKATI. Yes.

Mr. EHLERS. Thank you very much.

Thank you, Mr. Chairman.

Mr. GONZALEZ. Thank you, Mr. Ehlers.

We have to make it real clear, the GAO are really evidence-gatherers for us, and then we will make those determinations.

But I do want to point out that, when we tasked GAO as to exactly what they were going to be doing, we were very clear that, in the final analysis, this first part of the work that you were doing, the last subpart was: Considering the tests that were conducted on the voting systems from Sarasota County after the general election, are additional tests needed to determine whether voting systems contributed to the undervote? That is what brings us here today.

And it seems pretty clear, on page 11, it says, "Prior tests and reviews provide some assurance, but do not provide reasonable assurance, that the iVotronic DREs did not contribute to the undervote. Prior tests and reviews of Sarasota County voting systems provide useful information but have some shortcomings."

So that is why it is necessary. You will be in a much better position to give us more probative and valuable information on which we may predicate a decision on the reliability of the results that were reported to us on the election in Florida-13.

And we have just been joined by Congresswoman Lofgren.

And thank you very much. I know you rushed over here.

And by the way, I have been told that she was on "The View" this morning.

Ms. LOFGREN. No, not me. It was——

Mr. GONZALEZ. I thought it was you.

Ms. LOFGREN. The Speaker was on there.

Mr. GONZALEZ. Oh, the Speaker. I thought it was you. We were saying Lofgren.

Oh, well, given my choice, it would have been Representative Lofgren.

This is being recorded, and I am sure the Speaker is watching. [Laughter.]

Ms. LOFGREN. That would not be my choice.

Mr. GONZALEZ. All right. Representative Lofgren, at this point, if you wish to ask any questions—I know you were not here, but you attended last week's briefing, and I think you were provided a draft of the report.

Ms. LOFGREN. Right.

Mr. GONZALEZ. If you have any questions——

Ms. LOFGREN. No, I think this is proceeding properly. And at the appropriate time, I will have a motion to offer when others are through with their questions. If that is now, I will do it now.

Mr. GONZALEZ. All right.

Ms. LOFGREN. Everyone is ready.

"I move that the task force approve the proposed GAO testing plan and associated protocols as follows: A, firmware testing to verify that the firmware in the iVotronic DREs used in Sarasota County matches the certified version; B, ballot testing of iVotronic DREs to confirm correct operation; C, miscalibration of an iVotronic DRE to understand the effect on the undervote.

I move further that the Chairman request that all individuals, offices and entities whose cooperation is necessary fully, promptly and voluntarily assist the GAO to enable it to conduct the testing described above."

That would be the motion.

[The information follows:]

FL-13 Task Force Motion # 6
Offered by Zoe Lofgren
October 2, 2007

Approve GAO Testing Plan and Associated Protocols

I move that the task force approve the proposed GAO testing plan and associated protocols as follows:

a. Firmware testing to verify that the firmware in the iVotronic DREs used in Sarasota County matches the certified version;
b. Ballot testing of iVotronic DREs to confirm correct operation;
c. Miscalibration of an iVotronic DRE to understand the effect on the undervote.

I move further that the Chairman request that all individuals, offices, and entities whose cooperation is necessary, fully, promptly and voluntarily assist the GAO to enable it to conduct the testing described above.

Mr. GONZALEZ. All right.

All in favor of the motion, vote, "Aye."

It is unanimous, and the record will reflect such.

Also, I want to make sure that the record will include, being part of the record, and that is the report as submitted by GAO today.

And we look forward to continuing working with you. Advise us immediately if you need some additional assistance in gaining access, any problems you have with logistics.

Anything further?

Mr. MCCARTHY. Mr. Chairman, I just want to congratulate you on this committee, because everything that we have done has been unanimous in our approach. And I think this is probably going to show, in the long run, how contested elections should be done in the future. So, thank you.

Mr. GONZALEZ. Well, I want to thank my colleagues for that.

And we stand adjourned.

[Whereupon, at 4:37 p.m., the task force was adjourned.]

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