ELECTRONIC DATA COLLECTION
AT THE U.S. BUREAU OF ECONOMIC ANALYSIS

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Abstract

This paper describes the electronic data collection system at the U.S. Bureau of Economic Analysis. Specifically, the paper focuses on the operation and management of the Automated Survey Transmission and Retrieval (ASTAR) system that has been in use since 2000, and the second generation of electronic data collection, eFile, that was introduced in 2005. The paper also addresses successes, past and current challenges, and the future of electronic data collection at the Bureau of Economic Analysis.

Keywords: Electronic data collection.

1. Introduction

The Bureau of Economic Analysis (BEA), an agency of the U.S. Department of Commerce, started collecting international investment data via the Automated Survey Transmission and Retrieval (ASTAR) system in the year 2000. Subsequently, the system was also used in connection with surveys of trade in services. One of the key features of the ASTAR system is its ability to allow respondents to work at their own pace until the data are ready for submission. The system also incorporates data export and import capabilities for integration with other software such as spreadsheets, as well as encryption capabilities that safeguard the confidentiality of the reported data. In 2005, BEA began researching electronic filing alternatives as a response to the changing technology, and selected Adobe e-forms as the basis of its second generation electronic survey data collection program, called eFile. This paper will include a brief description of BEA's survey collection programs, a description of the ASTAR system and its features, a description of the eFile system and its features, and future plans for BEA's electronic survey collection system.
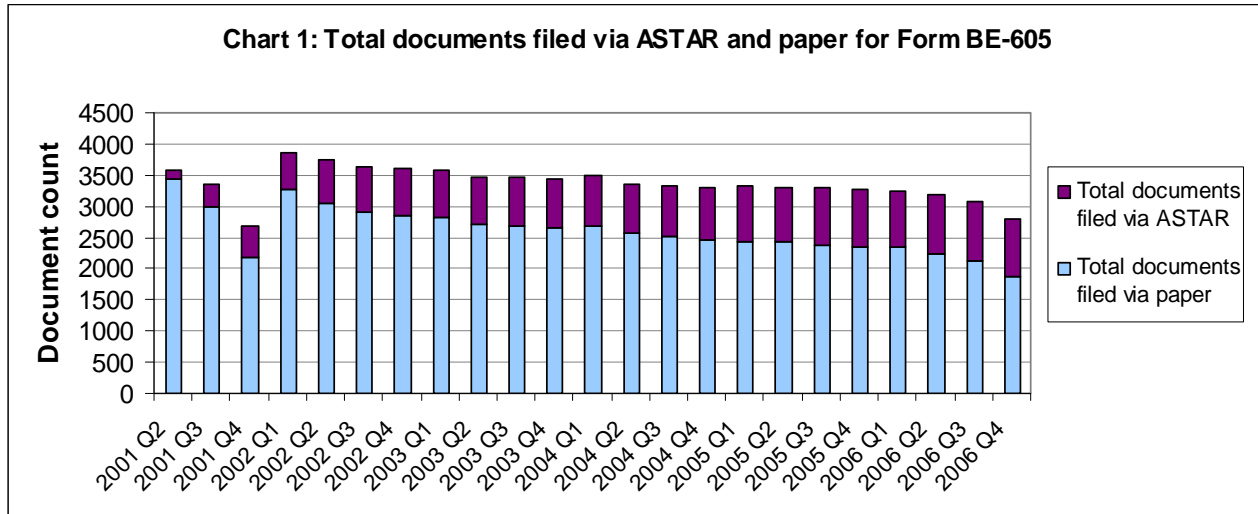
2. Background

2.1 Overview

BEA produces economic accounts statistics that enable government and business decision makers, researchers, and the American public to follow and understand the performance of the U.S. economy. Most of the source data that it uses are obtained from other government agencies and organizations, but it collects primary source data on foreign direct investment in the United States, U.S. direct investment abroad, and U.S. international services transactions on quarterly, annual and benchmark surveys. The data collected are used in compiling the U.S. international transactions accounts, national income and product accounts, and the international investment position of the United States. The data are also needed to measure the size and economic significance of direct investment and trade in services, and the impact of these activities on the U.S. and foreign economies.

Currently, BEA conducts sixteen mandatory confidential surveys and one voluntary survey. For each survey, the respondents may elect to file via paper, or electronically by using ASTAR or eFile. The eFile option is currently available for nine survey forms. Prior to implementing the electronic filing alternatives, the data collection program at BEA was conducted entirely in a paper-based system.

2.2 ASTAR as the First Generation Electronic Filing Method

Partly in response to the requirements of a law known as the Government Paperwork Elimination Act, BEA began researching and conducting pilots to evaluate various web interface and electronic data submission methods in the late 1990s. The results were used to develop the Automated Survey Transmission and Retrieval (ASTAR) system. The ASTAR prototype went into production for the second quarter of calendar year 2000 for the quarterly survey, Form BE-577, Direct Transactions of U.S. Reporter with Foreign Affiliate. Following the success of the prototype, ASTAR was expanded to another BEA quarterly survey, the Form BE-605, Transactions of U.S. Affiliate with Foreign Parent, and the related Form BE-605 Bank, Transactions of U.S. Banking Affiliate with Foreign Parent, in the second quarter of 2001. Over the next several years, the system was expanded to cover almost all BEA surveys.

Chart 1: Total documents filed via ASTAR and paper for Form BE-605

Legend:
- Total documents filed via ASTAR
- Total documents filed via paper

X-axis (quarters): 2001 Q2, 2001 Q3, 2001 Q4, 2002 Q1, 2002 Q2, 2002 Q3, 2002 Q4, 2003 Q1, 2003 Q2, 2003 Q3, 2003 Q4, 2004 Q1, 2004 Q2, 2004 Q3, 2004 Q4, 2005 Q1, 2005 Q2, 2005 Q3, 2005 Q4, 2006 Q1, 2006 Q2, 2006 Q3, 2006 Q4

Y-axis: Document count (0 to 4500)

2.3 eFile as the Second Generation Electronic Filing Method

In 2005, BEA began researching an alternative to its ASTAR electronic filing system as a response to the changing technology. The goal was to design a system that encompassed the functional features of ASTAR and new technological advancements since the birth of ASTAR. Adobe E-forms was selected as the most suitable alternative and the new system was named eFile. The eFile prototype, first supported by FormRouter Inc. in the areas of development services and data submission, encryption, and hosting, went into production in 2005 for Form BE-10, Benchmark Survey of U.S. Direct Investment Abroad.

Shortly after the successful implementation of the prototype, BEA began constructing PDF markup, encryption, and hosting of data collection in-house. In April 2006, BEA generated the first in-house eFile option for Form BE-11, Annual Survey of U.S. Direct Investment Abroad, in which the survey data are collected and submitted directly to BEA's database. Currently, nine surveys can be filed via eFile.[1] Over

the next 18 to 24 months, eFile will be expanded to cover all BEA surveys and replace the existing ASTAR system.

3. Automated Survey Transmission and Retrieval (ASTAR) System

The introduction of ASTAR as an electronic alternative to paper filing was welcomed by many BEA survey respondents. Prior to ASTAR, some respondents would fax the completed surveys or have them delivered by courier just before the deadlines. Respondents would then call and request confirmation that BEA received the form. However, any delay resulting from the mailing of forms, coupled with the time needed by BEA to record receipt of the forms, often made it difficult to provide the respondent with routine and immediate confirmation. In contrast, ASTAR electronic filing provides survey respondents with speedy e-mail confirmation of their submission, and provides survey editors the ability to verify the status of reports shortly after the form is submitted.

Although most respondents continue to file on paper forms, ASTAR submissions have been growing and currently account for nearly one-third of total responses. Chart 1 shows that as of May 2007, total documents for Form BE-605 filed via ASTAR as a percentage of total documents received has increased from 16 percent in the first quarter of 2002 to 33 percent in the fourth calendar quarter of year 2006.[2]

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[1] The eFile option is available for forms BE-9, Quarterly Survey of Foreign Airline Operators' Revenues and Expenses in the United States; BE-11, Annual Survey of U.S. Direct Investment Abroad; BE-29, Foreign Ocean Carriers' Expenses in the United States; BE-30, Ocean Freight Revenues and Foreign Expenses of United States Carriers; BE-37, U.S. Airline Operators' Foreign Revenues and Expenses; BE-45, Quarterly Survey of Insurance Transactions by U.S. Insurance Companies with Foreign Persons; BE-120, Benchmark Survey of Transactions in Selected Services and Intangible Assets with Foreign Persons; BE-125, Quarterly Survey of Transactions in Selected Services and Intangible Assets with Foreign Persons; and BE-185, Quarterly Survey of Financial Services

Transactions Between U.S. Financial Services Providers and Foreign Persons.

[2] For the third and fourth quarters of 2001, the availability of the ASTAR system was limited to a portion of respondents for testing purposes.

Chart 2: Documents Filed via ASTAR as a Percentage of Total Assets and Total Sales*
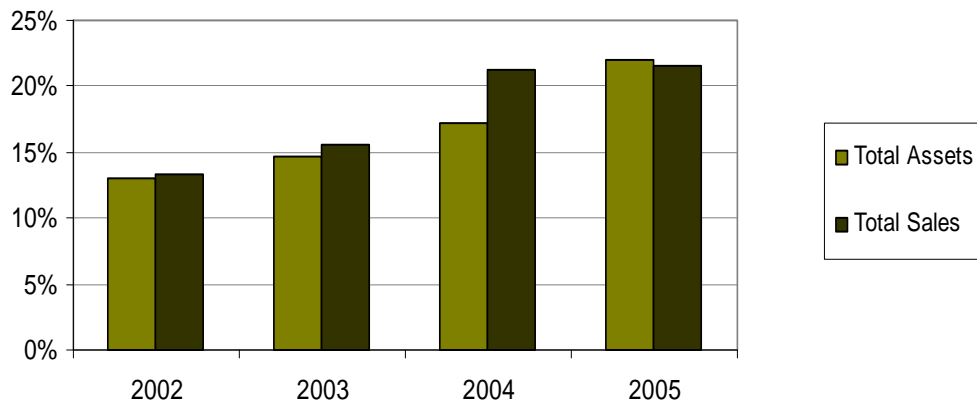
*Data obtained from the benchmark and annual surveys of foreign direct investment in the United States, BE-12/15.

Not only has the number of ASTAR users increased, these ASTAR users account for an ever increasing proportion of key metrics. Chart 2 shows that ASTAR filers accounted for 22 percent of total assets of all respondents to BEA's surveys on operations of U.S. affiliates of foreign companies in 2005, compared to 13 percent in 2002. Their share of total sales rose from 13 percent in 2002 to 22 percent in 2005.
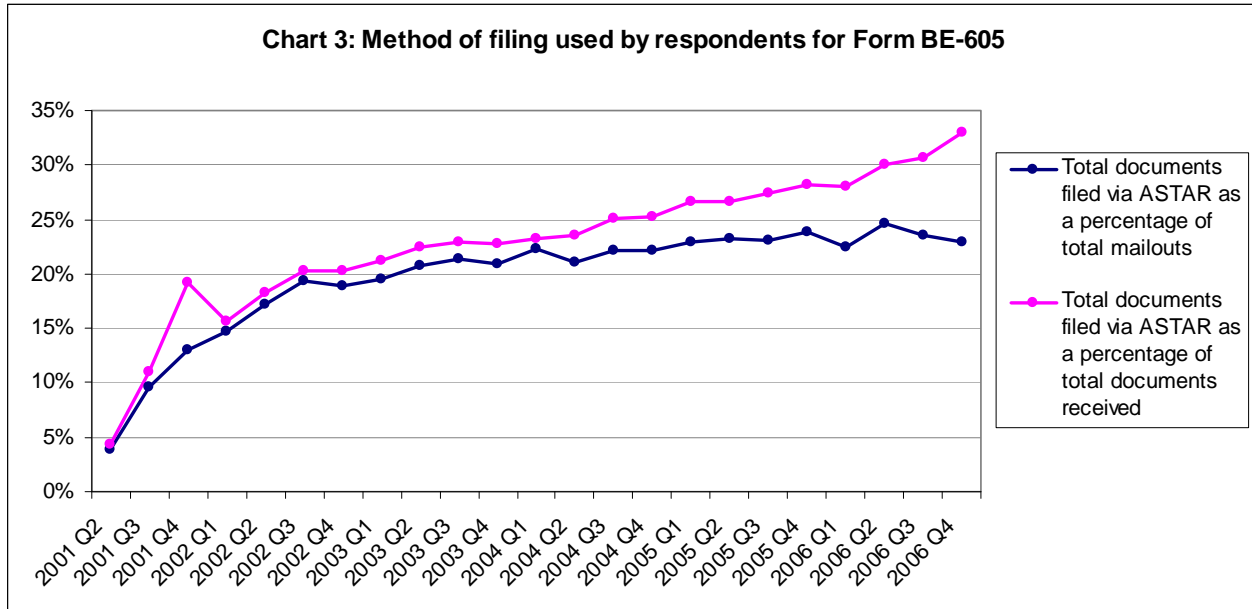
During the developmental phase of ASTAR, survey managers worked with IT specialists to discuss the needs of individual surveys and were presented with different options or features that could be implemented. The flexibility of ASTAR in providing features tailored to individual surveys allows survey managers to be creative in placing instructions and text, displaying pre-filled information based on previously reported data, and specifying the features of the tables and edit checks. For example, similar to many enterprise surveys, BEA surveys usually have significant amounts of additional text and instructions that have the potential to overwhelm survey respondents if placed or linked inappropriately on the screen. By working with IT specialists, survey managers identified key instructions and text that could be hyperlinked via a help button adjacent to the relevant data cells. Another ASTAR feature is the ability to allow respondents to work at their own pace and save intermediate results until the final data are ready for submission. The system also incorporates export and import capabilities for integration with other software, such as spreadsheets.

3.1 System Description of ASTAR

The respondent interface for ASTAR is run on a Java applet in the respondent's Internet browser via the BEA website. Respondents may choose to execute ASTAR on-line or off-line. The off-line option allows respondents in more stringent IT security environments to use ASTAR by connecting to the Internet only during the initial system load and final data transmission. Respondents may also work in multiple sessions in order to complete the forms.

Before entering the ASTAR environment, respondents must contact BEA to obtain a unique and period-specific password. The password allows respondents to retrieve and decrypt the pre-filled information, and re-encrypt the final submission. The encrypted transmission of the completed forms back to BEA is based on the unique identification numbers and passwords. If the system cannot directly post the submission via the web for any reason, the user can instead transmit its submission as an encrypted email attachment. During data entry and prior to submission, several basic validity checks are run to ensure the integrity of the data. ASTAR also generates printable completed forms in PDF format that can be saved on the respondent's computer network.

As previously mentioned, the ASTAR system includes import and export features. The import feature allows respondents to load the data in a prescribed Comma Separated Values (CSV) file format directly into ASTAR without the need for manual data entry. This file format can be used in subsequent filings until such time as the formats of the survey forms are revised.

Chart 3: Method of filing used by respondents for Form BE-605

Legend:
- Total documents filed via ASTAR as a percentage of total mailouts
- Total documents filed via ASTAR as a percentage of total documents received

X-axis: 2001 Q2, 2001 Q3, 2001 Q4, 2002 Q1, 2002 Q2, 2002 Q3, 2002 Q4, 2003 Q1, 2003 Q2, 2003 Q3, 2003 Q4, 2004 Q1, 2004 Q2, 2004 Q3, 2004 Q4, 2005 Q1, 2005 Q2, 2005 Q3, 2005 Q4, 2006 Q1, 2006 Q2, 2006 Q3, 2006 Q4

The import feature tends to be most widely used for the quarterly survey of U.S. direct investment abroad, Form BE-577. This may be due to several factors -- its frequency, the requirement for many respondents to submit multiple documents (one for each foreign affiliate), and certain aspects of the survey design. For this survey, the respondents can import the survey en masse for all the foreign affiliates of the reporting entity, rather than having to input one document at a time. Table 1 below summarizes the observable minutes per document spent by respondents to input the data for the quarterly survey Form BE-577. The information does not include time spent gathering the required data in order to complete the forms, nor does it account for any idle time between login and submission.

Table 1: Minutes Per Document for Form-577 ASTAR Users

	Average	Minimum	Maximum	Total Documents
2006 Q1	6.27	0.05	42.00	4973
2006 Q2	6.49	0.12	205.00	5013
2006 Q3	6.19	0.01	50.50	5609
2006 Q4	7.87	0.01	181.00	5528

The table shows that when BE-577 ASTAR users use the import feature to load and submit multiple documents, users may spend as little as 0.01 minutes per document in the submission time. Thus, the import feature can result in only very brief amounts of time being spent by respondents in the data entry portion of completing the survey forms.

Before the final transmission of data to BEA, the data are encrypted based on the unique identification numbers and passwords. The encrypted data are stored on BEA's web server. Periodically, the SQL server accesses the encrypted data, decrypts the data, and loads the data into BEA's internal database. Upon successful loading, the system generates an automated e-mail notification to the respondents confirming successful receipt. After the forms have been completed and submitted, ASTAR users can review the status of the reports in the main menu, and revise and resubmit their forms.

3.2 Successes of ASTAR

The ASTAR system significantly enhances BEA's ability to collect the survey data. The system improves timeliness of the data, as the data are loaded into BEA's internal database within roughly one hour of being submitted. In contrast, the paper submissions can take up to several weeks.[3] ASTAR users can minimize delays by submitting their forms electronically. The ASTAR system also allows respondents to submit their data during non-business hours, and it serves as an effective alternative to paper filing during unforeseen circumstances, such as the 9/11 terrorist attacks or an incident in which mail had been contaminated by anthrax. For example, Chart 3 shows that after 9/11, there was an increase in electronic filing activity as evidenced by the spike in

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[3] In recent years, the delays associated with paper submission have increased, due to new requirements that most mail delivered to BEA by the U.S. Postal Service be, for security reasons, irradiated prior to delivery.

the fourth quarter of 2001 in the total documents filed via ASTAR as a percentage of total documents received.[4]

The chart also shows that the ASTAR usage rate has increased from 19 percent in the fourth quarter of 2001 to 33 percent in the fourth quarter of 2006. Additionally, BEA has observed that ASTAR users tend to file either early or near the filing deadline.

The electronic filing method also helps BEA to reduce costs. For many BEA surveys, existing ASTAR users are sent only a letter of notification, whereas paper filers must be sent a letter, form(s), and instructions. In addition, the electronic filing method also reduces data entry costs.

The ASTAR system not only reduces costs, but it also significantly reduces the timeframe for accessing the reported survey data. For example, the duration of the data entry process can be considerable depending on the volume and the priority assigned to each survey based on the production schedules. Additionally, electronic filing reduces keypunch errors, thereby improving the quality of the data. Finally, the ASTAR system increases data integrity, as the data pass through a series of integrity checks prior to being submitted to BEA. (However, the use of checks has been limited, due to a concern that too many checks might deter respondents from filing electronically.)

3.3 Challenges of ASTAR

The main challenge of ASTAR is high maintenance costs. ASTAR maintenance costs are high relative to other electronic filing options – as discussed later, eFile has very low maintenance costs. First, ASTAR must be supported by an outside contractor. Second, significant maintenance effort must be devoted to keeping up with the technological advances and changes in web browsers, the Java environment, and client security configurations, as well as to updating the electronic formats to reflect changes in the forms. Third, there is a burden of password maintenance, as ASTAR users are given a unique period-specific password. Finally, there is limited flexibility in applying complex pre-submission edit checks in ASTAR. Not withstanding these costs, however, compared to paper filings, the maintenance costs of ASTAR are more than offset by savings in printing, postage, and survey processing.

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[4] Respondents were informed in the cover letter that accompanied the survey form that postal service to the BEA was severely disrupted by the anthrax threat. The letter also encouraged respondents to file electronically.

4. eFile: BEA'S Second Generation of Electronic Filing

Since the prototype of ASTAR went into production in 2000, the web and electronic survey environments have experienced technological advancement. In 2005, BEA began researching and developing an electronic filing alternative that utilizes new technologies, and identified the fillable and web-transmittable Adobe E-forms as the best alternative. This new electronic survey collection system encompasses many of the functional features of ASTAR, but it has significant user-friendly enhancements and is easier to develop and maintain.

4.1 System Description of eFile

One of the main advantages for users of the eFile system is its compatibility with any computer that has a recent version of Adobe Acrobat or the free Adobe Reader. Another advantage of the eFile system is the respondents' ability to change and update their passwords at the new eFile password "portal" site. The new password portal meets the E-authentication requirements where passwords are securely distributed and never transmitted via email. The password is never stored in "clear" text and is only known to the respondent.

To access eFile, respondents begin by completing an online form and submitting a password known only to themselves. After receiving a request, the portal verifies and validates the password by assigning the submitted password to the applicable UserID, and an e-mail confirmation is sent to the respondent. The respondent then confirms the password by following a link given in the email.

For the eFile prototype, BEA relied on an external vendor, FormRouter Inc., in the area of development of services and data submission, encryption, and hosting. BEA assumed these roles after the successful implementation of the prototype. Subsequently, BEA has implemented more validity and form-specific logic checks. Respondents now save and submit their data through the BEA website, and the data are securely transmitted via Secure Sockets Layer (SSL) and encrypted in the database on the BEA web server. Unlike the ASTAR system, the eFile system allows BEA to notify respondents of their successful submission almost instantaneously upon submission.

BEA is currently converting the existing surveys from ASTAR to eFile by building fillable PDF forms that are supplied by the U.S. Census Bureau, with which it has a contract for forms design and related services.

Three of the nine surveys that can be filed via eFile have been available only since late 2006, and the other six surveys have been recently introduced.[5]

Although eFile is new to these surveys, it has been rapidly adopted. Currently, only limited information on usage rates is available. In its first few months, 30 percent of all BE-45 respondents and 26 percent of all BE-120 respondents used eFile. However, the manager of these surveys observed that a greater proportion of exemption requests are filed via eFile than the paper method. Additionally, since BEA has observed that respondents who use electronic methods of filing tend to file early or near the filing deadline, the usage rates for these surveys could be adjusted downward as more paper filings are received.

4.2 Benefits and Features of eFile

One of the main benefits of the eFile system is the lower cost of maintenance when compared with ASTAR. The eFile system is supported and maintained in-house and not by contractors. More specifically, BEA can build the fillable PDF forms in-house (using the PDFs supplied by the Census Bureau), whereas ASTAR must be supported by contractors.

Another key benefit and feature of eFile is the password "portal" site. This password portal site for eFile users allows respondents to manage their own passwords, whereas for the ASTAR system, the respondents must contact BEA at the beginning of each reporting cycle to receive period-specific passwords. The ease of eFile password management reduces BEA's burden of password maintenance and may also encourage more respondents to use the eFile system.

The eFile system has the potential to collect more accurate data, as fillable PDF forms allow more flexibility in validity and form-specific logic checks than ASTAR. Additionally, BEA can better ensure data security as respondents save and submit their encrypted data on the BEA website. Lastly, eFile users receive confirmation of their submissions almost instantaneously, whereas ASTAR respondents receive confirmation only after the data have been loaded into BEA's internal database.

5. Future steps of electronic filing

BEA is committed to providing timely and accurate economic accounts data in a cost effective manner. Over the next 18 to 24 months, BEA will phase out ASTAR and convert to eFile for all of its surveys. BEA also plans to develop an XML-based import and export feature that would allow respondents to import their data directly into eFile without the need to enter data manually. As the usage of eFile spreads to all BEA surveys, new challenges undoubtedly will be identified. The survey managers and IT specialists at BEA are committed to work together to improve and augment the system.

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[5] The collection period for the eFile prototype Form BE-10, Benchmark Survey of U.S. Direct Investment Abroad for 2004 has ended. Thus, data for Form BE-10 are no longer collected via eFile.