

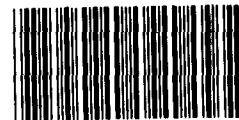
GAO

Report to the Ranking Minority Member,
Subcommittee on Aviation, Committee
on Public Works and Transportation,
House of Representatives

March 1992

COMPUTER RESERVATION SYSTEMS

Action Needed to Better Monitor the CRS Industry and Eliminate CRS Biases



146269



**Resources, Community, and
Economic Development Division**

B-247612

March 20, 1992

The Honorable William F. Clinger, Jr.
Ranking Minority Member
Subcommittee on Aviation
Committee on Public Works and Transportation
House of Representatives

Dear Mr. Clinger:

Since they were first offered to travel agents in 1976-77, airline-owned computer reservation systems (CRS) have come to be used for over 90 percent of travel agents' domestic airline sales.¹ In past reports and testimonies, we have expressed concern about restrictive marketing practices associated with CRSS that make it difficult for non-CRSS-owning airlines to compete in the markets of the airlines that own the CRSS.² This report focuses on an issue we have not addressed in our previous reports—possible biases toward the airline whose internal reservation system is housed within the CRS it owns. Such systems are called “hosted” CRSS because the internal reservation system for the airline that owns the CRS is hosted within the CRS and uses some of the same hardware, software, and databases that operate the CRS. Several airlines and the two smallest CRS vendors believe that the design, or “architecture,” of hosted CRSS makes it easier and more reliable to obtain information and book flights on the host airline than on other participating airlines.³ This “architectural bias” could undermine airline competition by artificially transferring passengers—and therefore revenues—from airlines that do not control CRSS to those that do, thus contributing to a less than level playing field for marketing airline services. Recently, both the Congress and the Department of Transportation (DOT) have focused attention on CRS architectural biases.⁴

¹The Department of Transportation reported that in 1987—the latest year for which data are available—travel agents used CRSSs to book 92 percent of their domestic airline sales.

²Airline Competition: Impact of Computerized Reservation Systems (GAO/RCED-86-74, May 9, 1986); Competition in the Airline Computerized Reservation System Industry (GAO/T-RCED-88-62, Sept. 14, 1988); and Airline Competition: Industry Operating and Marketing Practices Limit Market Entry (GAO/RCED-90-147, Aug. 29, 1990).

³The term “participating airline” is sometimes used to refer to all airlines participating in the CRS, including the host. For convenience, we use this term to refer to airlines other than the host that participate in the CRS.

⁴Department of Transportation Notice of Proposed Rulemaking, 14 C.F.R. part 255, 56 Fed. Reg. 12586, March 26, 1991; H.R. 3620, introduced Oct. 23, 1991; and S. 2312, introduced March 4, 1992.

This report responds to your November 6, 1991, letter, in which you asked us to determine (1) whether differences in CRSS' treatment of host and participating airlines allow the CRS-owning airlines to sell additional seats at the expense of other participating airlines and (2) whether separating owner-airlines' internal reservation systems from CRSS—"dehosting"—would eliminate significant differences in CRS treatment of host and participating airlines more effectively than existing or proposed CRS technology improvements. As agreed with your office, the scope of this review did not include other competitive issues concerning CRSS, such as the reasonableness of booking fees paid by participating airlines to airlines that own CRSS.

Results in Brief

Differences exist in the way the design, or architecture, of CRSS treats host and participating airlines. These include differences in programming, such as the number of keystrokes needed to access particular functions for the host airline compared with participating airlines, as well as the availability of some functions to the host airline that may not be readily available to participating airlines, such as immediate confirmation of seat assignments. Other differences, however, such as problems with the reliability of communications between the participating airlines' reservation systems and the CRS computer, result from the sharing of hardware and software between a CRS and its host airline's internal reservation system and are more difficult to observe. These differences may make it easier and more reliable to obtain information and book flights on the host airline than on participating airlines.

Even though there is disagreement over the extent and significance of existing differences, CRS vendors and airlines generally agree that differences, to the extent they exist, should be eliminated. The two largest CRS vendors (Covia/Apollo and Sabre), which had a combined 1988 market share of 71 percent, and the principal airlines whose internal reservation systems they host (United and American, respectively) believe that existing differences have minimal impact on airline bookings. Nevertheless, these vendors have stated that they are acting to eliminate differences that do exist. In contrast, most airline officials that we talked with, as well as the two smallest CRS vendors (System One and Worldspan), which had a combined 1988 market share of 29 percent, believe that the existing differences in the treatment of host and participating airlines give host airlines a significant competitive advantage over participating airlines. They believe that CRSS will not be equally easy

to use and reliable for all airlines unless they are separated from their owners' internal reservation systems (dehosted).

The lack of current information makes it difficult to determine whether dehosting would eliminate significant differences in CRS treatment of host and participating airlines more effectively than current and proposed technologies would. DOT has compiled little current information on the CRS industry. DOT last collected detailed 1986 and 1987 CRS industry information for a 1988 report and updated some of these data to 1988 for a 1990 report. Technology and ownership shares in the CRS industry have changed since that time. Moreover, DOT has gathered no conclusive information on the extent of reliability problems in the transmission and processing of data between CRSS and participating airlines; nor has it gathered objective data on the potential costs of dehosting to CRS vendors, airlines, and air passengers.

DOT should undertake several actions now to help ensure that CRSS offer equal opportunities for all airlines that market their products through CRSS, including requiring CRS vendors to remove all of the functional differences in treatment between host and participating airlines that can be removed without dehosting. Furthermore, until DOT gathers and analyzes data on the reliability of CRS data communication linkages and on the cost of dehosting CRSS, it will be impossible to assess the impact of either planned CRS technical enhancements or dehosting. Finally, unless DOT undertakes a comprehensive and continuous program of data gathering, it will be difficult to monitor the impact of its CRS rules and to make more informed decisions on CRS matters.

Background

A CRS, which is a periodically updated central database, provides subscribers—mainly travel agents—with information on air fares and services and allows them to make reservations and issue tickets. A CRS's major component is one or more mainframe computers that process messages received from travel agents and other parties. These messages are relayed to the central computer. By prompting a computer terminal keyboard, the CRS user can review airline information and make bookings. Travel agents generally lease the necessary computer terminal and ticketing equipment from a CRS vendor. (App. II contains an overview of how a CRS operates.)

Airlines that choose to have service and fare information displayed in a CRS establish with the CRS vendor a contract that generally includes, among

other information, the level at which the airline wishes to participate in the system. Airline participation levels range from the minimal, at which only schedule data are displayed with no booking capability, to levels at which a travel agent may, through the CRS, connect directly with the participating airline's internal reservation system to book seats and obtain airline information. These most sophisticated participation levels, commonly referred to as "direct access" levels, provide airlines with the opportunity to give agents more detailed and up-to-date information than could be provided at the lower participation levels.⁵ However, airlines must pay more to participate at a direct access level, both because booking fees paid by the participating airline to the CRS are higher and because direct access hook-ups require additional airline investment in sophisticated computer and communication systems.

As shown in table 1, there are four major airline-owned CRSS in the United States: Apollo, Sabre, System One, and Worldspan.⁶ Currently, three CRSS also contain the internal reservation systems for the airlines that are the primary owners of each CRS. These hosted CRSS share some hardware, software, and databases with the primary owning airline's reservation system. System One—originally Eastern Air Lines' internal reservation system—is the only nonhosted domestic CRS.

⁵According to DOT, direct access features are easier to use today than in 1984, when its current CRS rules were adopted.

⁶Worldspan owns and operates two different CRSS: PARS and DATAS II. Worldspan is developing a hostless CRS that will, by the end of 1993, replace both PARS and DATAS II as the CRS marketed to travel agents.

Table 1: CRS Industry Overview

CRS	Owner	Airline internal reservation system hosted within CRS	Market share (1988)
Apollo	Covia Partnership (United Airlines, USAir, British Airways, Swissair, Alitalia, KLM, Air Canada)	United Airlines	27.9%
Sabre	Sabre Travel Information Network (American Airlines)	American Airlines	43.1%
System One	Continental Holdings, Inc. ^a	None	13.9%
Worldspan (PARS and DATAS II)	Northwest Airlines, TWA, Delta Air Lines	Northwest and TWA (PARS); Delta (DATAS II)	15.1% ^b

Note: Market share data are based on number of flight segments booked in calendar year 1988, the latest year for which data are available. All other data are current as of March 1992.

^aCurrent owner of System One; when Continental Holdings' bankruptcy plan is approved, System One's owner will become Continental Airlines.

^bCombined market share of PARS and DATAS II systems.

Source: GAO analysis of industry and DOT information.

As table 1 shows, most major domestic carriers today have some ownership interest in a CRS. Two of the four domestic CRS vendors are owned by more than one carrier, and one of these—Covia/Apollo—is owned by seven airlines.⁷ However, although all CRSs are owned by airlines, not all airlines use the CRS they own as a host for their internal systems. According to DOT, airlines acquired ownership interests in CRSs because they wished to have some control over, and thus protect their place in, the flight distribution system. DOT believes that, as a result, most large domestic airlines now have some protection against potential market abuses by other CRS vendors.

⁷United Airlines currently owns 50 percent, and is the "general managing partner," of Covia, which operates the Apollo CRS. On March 5, 1992, Covia officials announced that Covia will merge with Galileo, a European CRS system. After the merger is completed, the new organization—Galileo International—will no longer have a general managing partner, although United will serve in this role in the new firm's "national distribution company" for the United States and Mexico.

In 1984, the now-defunct Civil Aeronautics Board (CAB) issued rules governing airline-owned CRSs.⁸ Prior to the issuance of these rules, CRS vendors biased the CRS screen displays in favor of their airline owners by placing the owners' flights first in the listings of available flights, thereby influencing the travel agent to book more passengers on those flights at the expense of other airlines. This tendency of travel agents to book disproportionately on the vendor's airline as a result of screen bias created additional, or "incremental," revenues for the airline that owned the CRS. The 1984 CAB rules required that CRS display screens be unbiased and prohibited CRS owners from discrimination in how they enter information about participating carriers' flights into the CRS and how they offer service enhancements (any CRS product or service other than basic information display, booking, and ticket-issuing capability) to participants. These are the CRS rules currently enforced by DOT. The 1984 rules do not prohibit architectural bias. In reports issued after the CAB rules took effect, DOT⁹ and the Department of Justice¹⁰ agreed that CRS display screen bias had been virtually eliminated. However, in its 1988 report, using data provided by CRS vendors, DOT determined that incremental revenues continued after the 1984 CAB rules were implemented. While DOT did not know exactly what caused incremental revenues, it found that CRS-vendor airline revenues were 9 to 15 percent higher than what they would have been without CRS ownership.

Although no studies exist that show conclusively what causes incremental revenues, DOT believes that one primary source—in contrast to the previous bias through the system for ordering flights on the CRS screen displays—is CRS bias through the design or architecture (hardware and software) of these systems. This architectural bias results in part from the sharing of some hardware and software between the host airline's internal reservation system and the CRS. According to DOT, the fact that a CRS functions differently and/or better for a host airline than for a participating airline can result in vendor airlines receiving bookings that they otherwise would not receive. This phenomenon thus diverts revenues from participating airlines to the principal airlines whose internal systems are

⁸14 C.F.R. part 255, 49 Fed. Reg. 32562, Aug. 15, 1984; final rules became effective Nov. 14, 1984.

⁹Study of Airline Computer Reservation Systems (DOT-P-37-88-2, U.S. Department of Transportation, May 1988); and Secretary's Task Force on Competition in the U.S. Domestic Airline Industry: Airline Marketing Practices: Travel Agencies, Frequent-Flyer Programs, and Computer Reservation Systems, U.S. Department of Transportation (Feb. 1990).

¹⁰1985 Report of the Department of Justice to Congress on the Airline Computer Reservation System Industry, Washington, D.C. (Dec. 20, 1985).

hosted within CRSS and contributes to a less than level playing field for marketing airline services.

Currently, DOT and the Congress are considering a number of regulatory and legislative proposals to address the possible anticompetitive effects of CRSS. In our September 1988 testimony, we concluded that DOT should act to eliminate the anticompetitive features of the CRS market identified by DOT's May 1988 CRS report. DOT acted on this finding in September 1989, when it issued an advance notice of proposed rulemaking which announced that DOT was considering whether to readopt and, if so, whether to modify the 1984 CAB rules. In March 1991, DOT issued a notice of proposed rulemaking for the CRS industry. The proposed rules do not prohibit architectural bias, but the notice does request comment on whether architectural bias should be prohibited. The CAB's CRS rules were to expire in December 1990, but DOT has twice postponed its target date for re-issuing them. In the meantime, DOT has extended the old rules until the new rules are finalized. DOT's most recent deadline for issuing the new rules was May 1992. However, on February 21, 1992, DOT announced that it would probably not meet this target because the President's January 28, 1992, memorandum to department and agency heads, directing them to review their rules, will divert DOT staff from working on the CRS rules. The Congress is similarly considering a number of CRS-related bills, including two that would mandate the separation of airline internal reservation systems from CRSS (dehosting).¹¹

Differences in Treatment of Host and Participating Airlines Exist—Range of Strategies Is Considered

While some differences in the treatment of host and participating airlines in CRSS have been reduced, others still exist. While CRS vendors generally agree that screen display bias has been virtually eliminated, there is no consensus on the extent of remaining differences in the treatment of host and participating airlines. Two CRS vendors—Worldspan and System One—and officials from the majority of airlines with whom we spoke believe that the design, or architecture, of hosted CRSS makes it easier and more reliable to obtain information and book flights on the host airline than on other participating airlines.

The perceived differences in the extent and impact of such host advantages have led to a range of suggested government actions. These suggestions include (1) allowing the marketplace to dictate future

¹¹H.R. 3620 (introduced Oct. 23, 1991) and S. 2312 (introduced Mar. 4, 1992) would mandate separation of CRSSs from airline internal reservation systems (dehosting). Two other bills—S. 839 (introduced Apr. 17, 1991) and S. 1628 (introduced Aug. 2, 1991)—would mandate divestiture of CRS ownership by airlines.

technological innovation, (2) requiring that CRS vendors remove programming and procedural features that make it less convenient to book flights on participating airlines than on the host airlines, and (3) requiring that CRSs separate from their host airlines' internal reservation systems (dehosting).

Some Differences Stem From Communication Links and Software Translation

Some differences occur because the host airline's internal reservation system can communicate directly with the CRS, while participating airlines' internal systems must depend on additional communication lines and software to communicate with the CRS. An agent connecting with the CRS automatically connects with the host airline's most accurate and up-to-date flight information. When an agent requests certain types of information on a participating carrier, however (e.g., seat availability), the CRS must communicate with the airline's internal reservation system, which requires the use of communication lines and software to translate messages between the two systems, even when a direct access feature is used. (App. II provides a more detailed description of CRS communication connections and processes.) The CRS vendors and airlines that believe architectural bias exists assert that these extra factors can lead to problems, including the following:

- While an agent can easily obtain accurate information on seat availability and book flights directly on the host airline, the agent may need to execute additional keystrokes and/or contact an airline by telephone to access the most accurate information and book flights on participating airlines.
- While the agent receives instantaneous seat assignments on the host airline, there may be delays, ranging from several minutes to several hours, or inaccuracies in confirming seat assignments on participating airlines.

Such problems may occur for one of two reasons: (1) the communication links do not transmit the data correctly or (2) the computers in the airline's internal reservation system and the CRS fail to correctly interpret messages sent between the two (because the two computers often use different types of software, messages can be translated incorrectly). Because these factors are difficult to observe directly, there is disagreement over which factor contributes more often to delays and errors. Problems with communication links can be difficult to pinpoint and may be out of the CRS's control (e.g., due to weather conditions or other external interferences with the transmission lines). Because the CRSs have not systematically collected data on communication and software

translation problems, little information exists with which to assess their impacts.

Some Differences Stem From Programming

Other differences occur because the CRS has been programmed to function more efficiently or provide more information for host and/or owning airlines than for participating airlines. While these are relatively minor differences, they contribute to other factors that make it easier to obtain information on the host airline. The following are examples of these types of differences:

- Each of the four CRSS has at least one host/owner default¹² programmed into the system (although some functions for which defaults exist may be used infrequently).
- For code-shared flights (for which a commuter carrier uses the carrier code of a larger carrier as part of a marketing agreement), one CRS discloses more information, such as the name of the code-sharing carrier, for the host than for participating airlines.

Such differences that are attributable to programming can be eliminated through reprogramming. The two largest vendors acknowledged that these differences exist and said that, over the next year or two, they are planning to eliminate some of them (host defaults) on their own, without additional regulation.

Some Differences Stem From the Location of Proprietary Airline Data

Other differences occur because the host has access to information stored in the CRS database. These include the following:

- An agent can only establish frequent flyer accounts and immediately validate frequent flyer account numbers for the host airline (other airlines are reluctant to provide the CRS access to their frequent flyer databases because the host airline would then have access to participating airlines' proprietary data).
- Passenger name records (PNR) for the host airline may be more accurate in the CRS database than the records for participating airlines. This occurs because participating airlines are reluctant to provide the CRSS access to their internal PNRs. Inconsistent PNRs can result when changes are made to

¹²A default provides agents access to the information of host/owning airlines with fewer keystrokes than are needed to access participating airlines' information; when a carrier code is not specified for certain functions, the CRS assumes that the host/owning airline is desired and displays that airline's information. System One, which is not a hosted system, provides some defaults to its owner, Continental Airlines.

a PNR within the airline's system and the changes are not also made in the CRS database (or vice versa).

Different Strategies Are Proposed

Worldspan and its host airlines, System One and its owning airline, and officials of all the non-vendor airlines with whom we spoke believe that all of these differences provide the host airline a competitive advantage over participating airlines. They told us that, while existing differences may provide their airline owners competitive advantages, they believe that airlines should compete on the basis of their quality of service and not on the basis of CRS functionality differences. They said that, while individual differences between the treatment of host and participating airlines appear to be small, the differences in the aggregate and over time cause travel agents to have more confidence in information provided on the host airline. Greater confidence, they believe, leads to more bookings on—and more revenue for—the host airline than would be made if the agent were equally confident in flight information on participating airlines.

To eliminate differences between the treatment of host and participating airlines, Worldspan, System One, and officials from most of the airlines with whom we spoke propose additional regulation. They believe that the government should require CRS vendors to provide equal opportunities to host and participating airlines. In addition, to ensure that equal opportunities are available, these officials favor mandatory dehosting, or the separation of CRSS from their host airlines' internal reservation systems. They maintain that dehosting is the only way to ensure equal opportunities for host and participating airlines. Any action short of dehosting, they believe, would fail to address one of the fundamental advantages of host airlines—the ability to communicate directly with the CRS database without traversing communication links, which can be unreliable.

The two largest CRS vendors—Covia/Apollo and Sabre—and their host airlines maintain, on the other hand, that there are few differences in the treatment of host and participating airlines within hosted CRSS. They recognize that some vestiges of host preference exist, such as certain functions—which may or may not be used by agents on a regular basis—that default to the host airline's information if the agent does not specify an airline, but they believe that such differences provide no competitive advantages to the host airline. These vendors and their hosts also believe that the marketplace, in the form of pressure from participating airlines and travel agents, has successfully dictated

technological changes that have eliminated many forms of host preference.

Therefore, Covia/Apollo and Sabre, as well as their host airlines, United and American, believe that the government should allow the marketplace to dictate future changes in CRS technology, which they believe already provides equal opportunities for host and participating airlines. For example, Covia/Apollo and Sabre said that they are currently taking actions to remove all host defaults in their systems. Furthermore, Sabre is developing its "seamless connectivity" product, through which, Sabre representatives believe, travel agents will notice no difference in accessing information between host and participating airlines (i.e., the system will mimic the host's functionality by providing real-time seat availability information on the participating airlines). Because seamless connectivity is still in development (Sabre said that it will be implemented in 1993), it is too early to know whether it will address all of the differences between host and participating airlines.

Data Are Needed to Assess the Need for Dehosting and to Monitor Changes in the CRS Industry

Resolving the critical issue of dehosting requires additional data that are not currently available. Data currently available on the extent of problems in communication linkages are not usable for analysis. Although DOT recently collected information on the reliability of CRS data links, most of the information collected, according to DOT, was unusable and not comparable across CRSS. Furthermore, there is no consensus on what dehosting would cost, partly because the exact technical characteristics of dehosting are uncertain. Dehosting could potentially impose costs on participating airlines and air passengers, as well as on CRS vendors. DOT, however, has not gathered any objective data on these potential costs.

Moreover, the CRS industry is changing—technological advances are occurring, ownership is more diverse, and profits and market shares may be changing. These continuing changes in the CRS industry will gradually reduce the value of the data that DOT currently has on the industry's structure and performance. Whatever rules DOT finally adopts, it will need a continually updated database to assess the effectiveness of those rules as the industry changes. Ensuring an appropriate regulatory framework will require access to regularly updated data on the structure of the CRS industry; the relationship between the vendor used by a travel agent and the travel agent's booking patterns; the extent of differences in the ease and reliability of selecting and booking flights on different airlines; and the costs and technological opportunities for eliminating these differences.

Conclusions

Differences exist in CRSS' treatment of host and participating airlines. These differences could have an adverse effect on airline competition because the relative ease and reliability associated with booking on a host airline may influence agents to make more reservations on host airlines than on participating airlines. These differences include cases where the system automatically assumes the host carrier is desired if no other carrier is chosen (host defaults); cases where more data are provided for the host carrier than for the participating carriers (e.g., more information on code-sharing flights); cases where features may function more quickly and easily for host carriers than for participating carriers (e.g., immediate confirmation of seat assignments), and differences in the number of keystrokes necessary to execute a function between host and participating carriers (e.g., to enter a participating airline's internal reservation system through a direct access feature). Some of these differences, such as the ease of establishing and checking passenger name records and frequent flyer numbers, may be difficult to eliminate because they might require the participating airlines to provide proprietary marketing information to the CRS host.

CRS vendors agree that these differences, to the extent they exist, should be eliminated, though they disagree as to the competitive significance of these differences. The vendors said that they are acting to eliminate some of these differences to remove any possible adverse competitive effects as well as the perception that participating airlines operate under a competitive disadvantage. Whether the differences will be eliminated as a result of the vendors' proposed new systems and technical enhancements can only be determined when the new systems and technical enhancements are in place. Moreover, since DOT is not currently requiring elimination of these differences, vendors could decide in the future to reverse their plans to eliminate them. Hence, we cannot be certain when or whether current programming revisions proposed by CRS vendors will take place or how effective they will be in equalizing the ease and reliability of booking flights on participating airlines in the absence of a regulatory requirement.

The CRS vendors disagree on the existence of differences in the reliability of communication links, and hence disagree on the need to dehost their systems to eliminate these differences. The data currently available on the reliability of these communication links are inconclusive. We have therefore not been able to determine either the degree of unreliability in the communication links used by participating carriers or the competitive impact of the differences in communication links that exist between the

host and the participating carriers. We have also not been able to determine the likely costs of dehosting the hosted CRSS and are therefore unable to confirm whether the competitive advantages of dehosting are commensurate with its costs. We are therefore not able to conclude at this time that the separation of CRSS from the internal reservation systems of the airlines that own them (dehosting) should be required.

DOT has not collected some of the information necessary to assess the competitive impact of differences in treatment between host and participating airlines. In particular, it has not been able to gather usable data on the technical reliability of data communication linkages relied upon by participating airlines. These data would be necessary to assess the differences in reliability available to host and participating airlines. DOT has also not assessed the costs of equalizing the quality of these linkages. Moreover, the last data on CRS market shares were gathered by DOT in 1988. Additionally, DOT has not gathered data on booking patterns by individual travel agents—data that would be necessary to assess the impacts that CRS use may have on booking patterns.

DOT has also not acted expeditiously to conclude its CRS rulemaking. Although we concluded in 1988 that DOT should take action to eliminate the anticompetitive features of CRSS, it took DOT a year to issue an advance notice of proposed rulemaking. DOT required an additional year and a half to issue a proposed new CRS rule. DOT is now over a year behind its original target to issue a final rule by the time the 1984 CAB rules expired in December 1990. DOT has dropped its revised target date of May 1992, and no new target date has been set. In view of these protracted delays, we conclude that the Congress has no assurance on when the Department will act to correct competitive problems of the CRS industry.

Recommendation to the Congress

We recommend that the Congress direct the Secretary of Transportation to revise the Department's existing CRS rules to require that each CRS vendor eliminate those functional differences between host and participating airlines that can be eliminated without dehosting. If vendors assert that proprietary data are necessary to eliminate some differences, such as checking passenger name records and frequent flyer numbers, the burden of proof should be on the vendors to demonstrate that such differences in treatment cannot be eliminated without access to proprietary data.

Recommendations to the Secretary of Transportation

We recommend that the Secretary gather data both on the technical reliability of data communication linkages used by participating airlines as compared with the internal linkages used by host airlines and on the costs and benefits of dehosting CRSS. Such data would help DOT and others to assess the effect of CRS technical enhancements (e.g., Sabre's seamless connectivity) as well as the potential need for dehosting. We also recommend that the Secretary establish a comprehensive and continuous program of gathering data on the CRS industry, including gathering data on market shares of CRS vendors and on booking patterns by travel agents using the various CRSS. Such data would allow DOT to monitor the effectiveness of its rules and alert it to the need for further regulatory changes in this dynamic industry.

Agency and CRS Vendor Comments

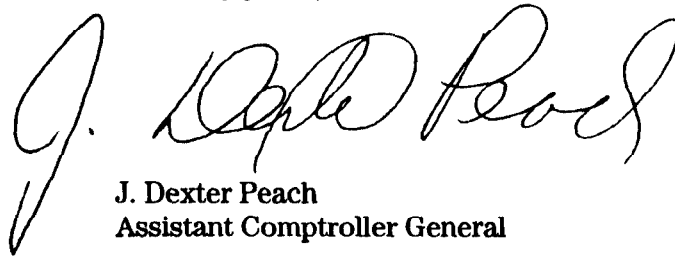
We discussed this report with senior officials of the Office of the Assistant Secretary of Transportation for Policy and International Affairs, who generally agreed with the facts in the report. They acknowledged that their CRS data were becoming old and, although data collection could be problematic, more current data would be useful for assessing the impact of CRSS on airline competition. Because the need to eliminate differences in the ease and reliability of booking on host and participating airlines is an issue in their pending rulemaking, they offered no official comments on this issue. As agreed with your office, we did not obtain written agency comments on a draft of this report. In addition, as agreed with your office, we discussed the factual content of this report with officials of the four domestic CRS vendors, who generally agreed with the facts in this report. As appropriate, we amended the text to reflect these officials' comments.

We obtained information for this report from CRS vendors, airlines, the Departments of Transportation and Justice, and several organizations involved in CRS data compilation and transmission. A more detailed description of our objectives, scope, and methodology appears in appendix I. We conducted our review between November 1991 and February 1992 in accordance with generally accepted government auditing standards.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send a copy to the Secretary of Transportation. We will make copies available to others upon request.

This work was performed under the direction of Kenneth M. Mead, Director, Transportation Issues, who can be reached on (202) 275-1000 if you or your staff have any questions. Other major contributors to this report are listed in appendix IV.

Sincerely yours,



J. Dexter Peach
Assistant Comptroller General

Contents

Letter		1
Appendix I		18
Objectives, Scope, and Methodology		
Appendix II		19
CRS Communications Arrangements		
Appendix III		22
Basic CRS Functions	Neutral Screen Availability Display, Including Classes of Service	22
Appendix IV		28
Major Contributors to This Report		
Table	Table 1: CRS Industry Overview	5
Figures	Figure II.1: CRS Connectivity	19
	Figure II.2: Comparison of CRS Booking Functions Under Different Connectivity Arrangements	21
	Figure III.1: Apollo Neutral Basic Availability Display	24
	Figure III.2: Sabre Neutral Basic Availability Display	25
	Figure III.3: System One Neutral Basic Availability Display	26
	Figure III.4: Worldspan Neutral Basic Availability Display	27
	Figure III.4: Worldspan PARS Neutral Basic Availability Display	28

Abbreviations

ARINC	Aeronautical Radio, Inc.
ATP	Air Tariff Publishing Company
CAB	Civil Aeronautics Board
CRS	computer reservation system
DOT	Department of Transportation
GAO	General Accounting Office
OAG	Official Airline Guides, Inc.
PNR	passenger name record
SITA	Air Transport Industry World-wide Telecommunications and Information Services

Objectives, Scope, and Methodology

In a November 6, 1991, letter, Representative William F. Clinger, Jr., Ranking Minority Member, Subcommittee on Aviation, House Committee on Public Works and Transportation, asked us to examine the issue of airline CRSS and the marketing advantages they may confer to their owning airlines. In response to this letter and in subsequent discussions with his office, we agreed to determine (1) if owning airlines enjoy a competitive marketing advantage over non-owning carriers and (2) whether separating owner-airlines' internal reservation systems from CRSS—dehosting—would eliminate significant differences in CRS treatment of host and participating airlines more effectively than current and proposed technologies would. As agreed with Mr. Clinger's office, the scope of this review did not include other competitive issues concerning CRSS, such as the reasonableness of booking fees paid by participating airlines to airlines that own CRSS.

For information on how CRSS function and on airline competition issues involving CRSS, we obtained information from the Departments of Transportation (DOT) and Justice. We reviewed the comment file for DOT's Notice of Proposed Rulemaking (DOT Docket Number 46494) to gain a broad understanding of opinions on and concerns about CRS issues.

To obtain information specific to CRS functioning and differences between CRS systems, we met with and received CRS demonstrations from officials of each of the four domestic CRS vendors: Covia/Apollo, Sabre, System One, and Worldspan. We also interviewed officials of, or obtained information from, 14 airlines, including airlines that have ownership stakes in CRSS. Additionally, we interviewed officials of three organizations that compile and/or transmit airline data for CRSS. We also interviewed officials of the American Society of Travel Agents and the Association of Retail Travel Agents. However, we did not conduct a scientific survey of travel agent behavior.

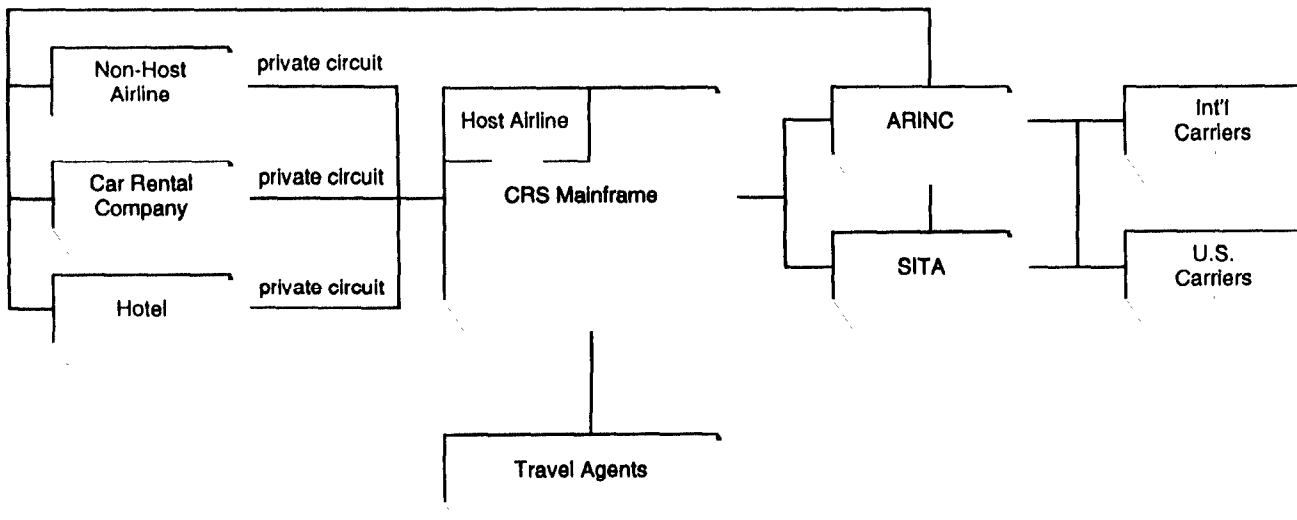
Appendix II contains information on CRS communications arrangements. Appendix III contains a summary of selected information we obtained from CRS vendors regarding basic CRS functions.

We conducted our review between November 1991 and February 1992 in accordance with generally accepted government auditing standards.

CRS Communications Arrangements

Figure II.1 shows how the computer systems of various participants are connected to the CRS. As discussed earlier in this report, the host airline's database resides within the CRS mainframe. There are no communication links between the CRS and the host airline's data. As shown in figure II.1, all other participants exist outside the CRS mainframe. They communicate with the CRS over various links—sometimes over communications links operated by ARINC or SITA,¹ and sometimes over private circuits.

Figure II.1: CRS Connectivity



Source: GAO analysis of industry data.

¹ARINC (Aeronautical Radio, Inc.) and SITA (Air Transport Industry World-wide Telecommunications and Information Services) are communications networks used by airlines and the CRSs. ARINC provides communication links within the United States, while SITA provides links internationally.

Figure II.2 compares the communications processes that occur when an agent books a flight on a particular airline. The first diagram shows a booking on the host airline, which the agent is able to perform by communicating directly with the CRS over a dedicated circuit. Because the host airline's database resides within the CRS, no additional connections are necessary.

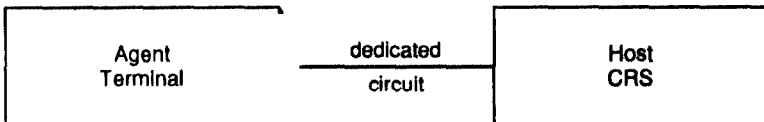
The second diagram in figure II.2 shows a booking on a participating (nonhost) airline that participates at the direct access level of a CRS. As with the host carrier, the agent communicates with the CRS over a dedicated circuit. The agent is then connected over additional communication lines via direct access software to the participating airline's reservation system.

The final diagram shows a booking on a nonhost airline that does not participate in direct access. In this case, the agent is again connected to the CRS by a dedicated circuit. The agent communicates further with the airline's reservations system through ARINC or SITA via the relevant software.

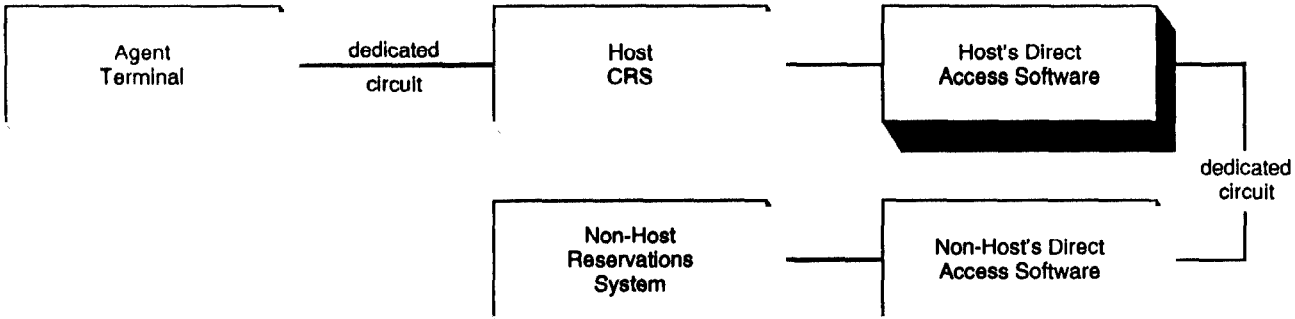
**Appendix II
CRS Communications Arrangements**

Figure II.2: Comparison of CRS Booking Functions Under Different Connectivity Arrangements

Agent Books Host Airline

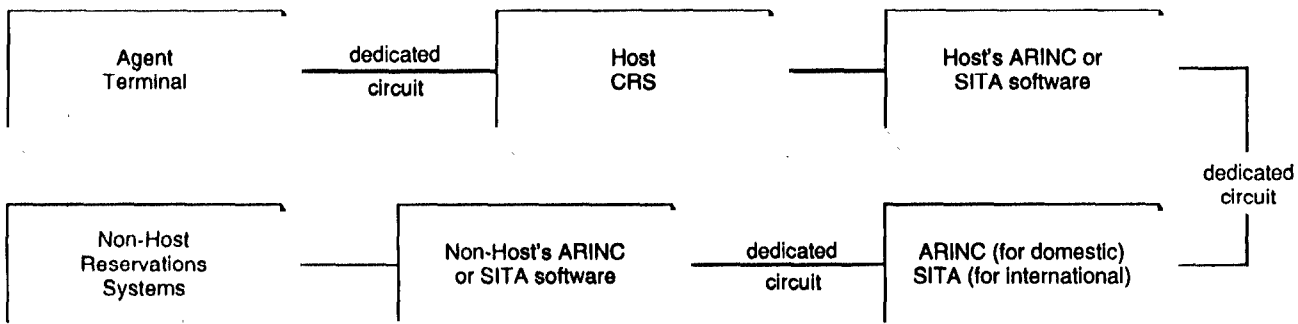


Agent Books Non-Host Airline Using a Direct Access Product



Agent Books Non-Host Direct Access Not Available

(Only works for some parts of transaction. For others, telephone call must be placed from agent to airline.)



Source: GAO analysis of industry data.

Basic CRS Functions

During this assignment, we received CRS demonstrations from the four domestic vendors.¹ The vendors demonstrated a number of functional areas, including the “neutral” (primary) screen display of flight availability and classes of service. The information presented in this report is intended only to be illustrative of CRS functioning as presented to us; we did not analyze the significance of functional differences.

Neutral Screen Availability Display, Including Classes of Service

Each of the CRSS provided an apparently neutral basic availability display screen when certain keystroke combinations were entered. Copies of each CRSS’ basic neutral availability screen, along with the exact keystroke entries required to obtain it, are shown in figures III.1-4.

Although there are some differences in the actual information display between the CRSS, all generally give the agent the same information. For each flight, reading from left to right, the display shows airline code, flight number, classes of service and whether seats are available in each, the origin and destination cities, the departure and arrival times, type of aircraft, and whether a connection or change of aircraft will be required en route. Also, with the exception of Worldspan/PARS, each CRS’s basic display will tell the agent, through a special code, whether an airline on the display participates at that CRS’s “direct access” level—the system for linking directly into the airline’s internal reservation system. In the columns showing classes of service availability, each letter designates a particular fare class and the number next to it tells the agent whether that fare class is available for sale. This basic display also gives information on each flight’s historical on-time performance, denoting, to the nearest 10 percent, how often the flight is on time.

Differences in Availability Display Between Host and Participating Airlines

The CRS displays shown in figures III.1-4 illustrate a difference between the availability information displayed for host airlines and for participating airlines in the neutral screen. Generally, the host airline’s availability information will be the true available inventory for that flight and is shown in a “real-time” display—as seats on the flight are sold, the display will reflect the actual change in availability by showing fewer seats available. Thus, flights of the host airline may be booked from the neutral display with virtual certainty that the displayed information is accurate.

¹Worldspan’s demonstration focused on the PARS system, which is the only CRS being actively marketed by Worldspan at this time and is the system on which the hostless Worldspan system will largely be based. Worldspan did, however, present some information on its DATAS II system for comparison with the PARS system.

For a participating airline's flight, however, the primary screen will generally display either a "4," indicating seats in that service class on that flight are open for sale, or a "0," indicating that class is sold out.² An agent may attempt to book a participating airline's flight from the neutral screen, or if he or she wishes to obtain more detailed and current information on this flight, he or she must enter additional CRS commands to move into a direct access program that links with the participating airlines' internal reservation systems.³ Thus, knowing that obtaining additional information on a participating airline's flight will take additional time and effort, an agent may decide to book on the host airline's flight from the neutral display. We did not, however, analyze these time differentials or their impact on airline bookings.

²Continental Airlines (abbreviated in CRS displays as "CO") has elected to have "7" displayed in CRS neutral availability screens to designate a class of service as open for sale. Because its internal reservation system is not hosted, however, Continental does not have real-time decrementing of its seat inventory on CRSs' neutral screens.

³This feature is only available for airlines that have elected to participate at a direct access level in the CRS.

Appendix III
Basic CRS Functions

For basic availability information on flights from Denver (DEN) to Minneapolis/St. Paul (MSP) on February 1 without specific time of day requested, the agent enters A1FEBDENMSP on the CRS terminal keyboard. Apollo's screen displays:

Figure III.1: Apollo Neutral Basic Availability Display

```
SA 01FEB  M C
1: NW 560 F4 Y4 B4 H4 Q4 M4 K4 V4 DENMSP 755A 1045A M80 S-S-8 0
2 7UA 986 F8 Y9 B9 M9 H9 Q9 V9 DENMSP 700A 945A 737 B-B-8 0
3: NW 562 F4 Y4 B4 H4 Q4 M4 K4 V4 DENMSP 930A 1220P M80 S-S-5 0
4  UA1640 F9 Y9 B9 M9 H9 Q9 V9 DENMSP 1033A 124P 722 L-L-5 0
5+ CO 494 F0 A0 Y0 B0 H0 Q0 K0 V0 DENMSP 1035A 141P 73S L-L-6 0
6: NW 568 F4 Y4 B4 H4 Q4 M4 K0 V4 DENMSP 1100A 145P D9S S-S-3 0
7+ CO1722 F5 A4 Y7 B7 H7 Q7 K7 V7 DENMSP 103P 401P 72S L-L-N 0
8: NW 564 F4 Y4 B4 H4 Q4 M4 K0 V4 DENMSP 130P 418P M80 S-S-7 0
```

Source: Covia Partnership.

Appendix III
Basic CRS Functions

For basic availability information on flights from Dayton (DAY) to Seattle (SEA) on February 27, departing at or about 5 p.m., the agent enters 127FEBDAYSEA5P on the CRS terminal keyboard. Sabre's screen displays:

Figure III.2: Sabre Neutral Basic Availability Display

27FEB	THU	DAY/EST	SEA/PST-3												
1NW1535	F4	Y4	B4	M4	H4	Q4	U4	DAYDTW	9	500P	556P	DC9	0	TA	
2NW 581	F4	Y4	B4	M4	H4	Q4	U4	SEA	7	700P	850P	757	D	0	TA
3AA 723	F7	Y7	B7	H7	M7	Q7	U7	DAYORD	8	517P	527P	580	0		
4AA 349	F7	Y7	B7	H7	M7	Q7	U7	SEA	6	625P	903P	580	D	0	
5UA 595	F4	Y4	B4	M4	Q4	H4	U4	DAYORD	8	520P	542P	733	0	XJ	DC
6UA 159	F4	Y4	B4	M4	Q4	H4	U4	SEA	5	700P	920P	D10	D	0	DC

Note: All the flights shown in the above Sabre display are connecting flights—Northwest (NW) through Detroit (DTW), and American (AA) and United (UA) through Chicago-O'Hare Airport (ORD).

Source: American Airlines/Sabre Travel Information Network.

Appendix III
Basic CRS Functions

For basic availability information on flights from Newark (EWR) to Los Angeles (LAX) on January 20, departing at or about 7:00 a.m., the agent enters A20JANEWRLAX7A on the CRS terminal keyboard. System One's screen displays:

Figure III.3: System One Neutral Basic Availability Display

MO	20JAN	E	P	ALT*	ORIG*	DEST									
1	UA	31	F4	Y4	B4	M4	Q4	EWR	LAX	800A	1105A	757	B-	B-	0*9
			H4	V4											
2	AA	43	F4	Y4	B4	M4	V4	EWR	LAX	800A	1106A	D10	B-	B-	0*6
			Q4	H4	K4										
3	DL	235	F4	Y4	B4	M4	Q4	EWR	LAX	800A	1115A	757	B-	B-	0/9
			H4	K4	L4										
4	CO	223	<u>F7</u>	A7	Y7	Q7	H7	EWR	LAX	825A	1140A	AB3	B-	B-	0/5
			K7	B7	V7										

Source: System One.

Appendix III
Basic CRS Functions

For basic availability information on flights from New York's Kennedy Airport (JFK) to Fort Lauderdale (FLL), Florida, on April 15 at or about 5:00 p.m., the agent enters A15APRJFKFLL5P on the CRS terminal keyboard. Worldspan's (PARS) screen displays:

Figure III.4: Worldspan (PARS) Neutral Basic Availability Display

```
15APR-WE-5P JFK FLL (NYC/FLL) ET ET                END
ALTERNATE EWR HPN JRE LGA TSS
1 DL 153 FO YO BO HO QO MO KO LO JFKFLL 515P 815P 7 757 DDO
2 TW 159 F9 Y9 M9 B9 QO VO KO JFKFLL 435P 740P 8 72S DDO
3 AA 363F@4Y@4 B4 H4 QO M4 KO VO JFKFLL 620P1103P 9 72S DD1
4 DL 151 F4 Y4 B4 H4 Q4 M4 K4 L4 JFKFLL 800A1055A 6 757 BBO
5 TW 239 F9 Y9 M9 B9 Q9 V9 K9 JFKFLL 800A1058A 9 72S BBO
6 BE 121 Y- Q- M- JFKFLL 725A1005A 72S 0
```

Source: Worldspan.

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