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the help of powerful internal Client/Server systems. As in the past, customers now go back to calling the airline directly and pay there and then with their credit card. This aggressive procedure has forced many other airlines to also make direct reservations and by-pass the CRSs. Some carriers, such as Swissair, have come to an agreement with major travel agent chains which then can make their reservations directly in the system of the respective airline. Some of the major travel agents like American Express offer the possibility to various airlines and hotels to dis-

play their services directly in the travel agents' internal systems. This could sufficiently substitute the scope of services provided by CRSs and the cost of communication between the service provider and the travel agent can be reduced. However, this would increasingly counteract the idea of creating a global electronic market.

Conclusion

In short, it can be stated that on the one hand the global computer reservation systems have reached a significantly high

economic and technological level and travel agents would hardly be able to do their work without these tools. On the other hand, however, because of the high costs incurred many providers avoid using this consistent concept with its complicated functional requirements and worldwide networks. Therefore, the CRSs are now at a turning point. Either the systems adapt to the new market conditions or they will become an early example for the destruction of the worldwide electronic markets.

Fact File: The Four Global Distribution Systems in the Travel and Tourism Industry

by Karsten Kärcher – University of Strathclyde, Glasgow

Background information on key electronic market systems (EMSs) in the global travel and tourism industry is presented in this fact file. The major travel and tourism EMSs portrayed are the four global distribution systems (GDSs) Amadeus, Galileo International, SABRE and Worldspan. The historical (or evolutionary) development of the technologies of the four GDSs is shown in Figure 1, indicating how the technology of one GDS was based on another. The Société Internationale de Télécommunications Aéronautiques (SITA) is also outlined, which supplied telecommunication services to several of the GDSs and other travel and tourism organisations.

however, SAS sold its share to the other three due to financial difficulties following the Gulf War, leaving Amadeus equally owned by the other three airlines. The Amadeus Central System was based on the software of the reservation system System One and located in Erding near München in Germany. The system became operational in 1991, integrating the four national reservation systems Esterel in France, Savia in Spain, Smart in Sweden

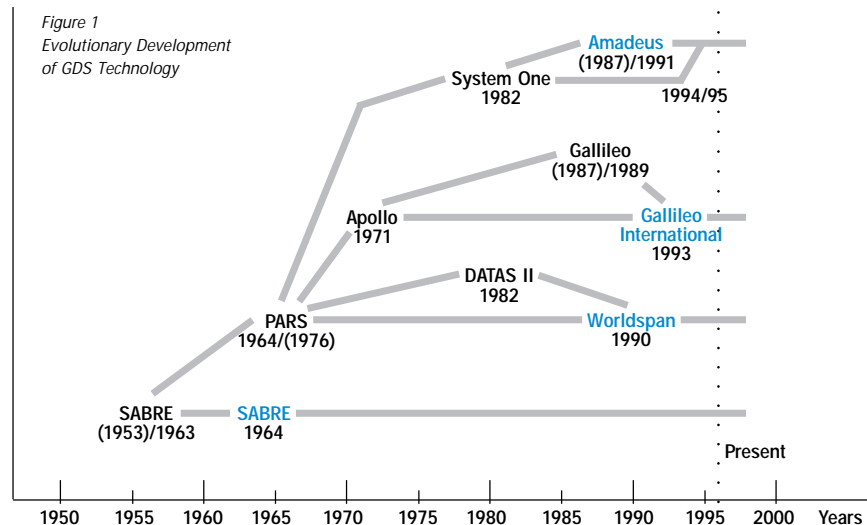
and START in Germany, which were predominantly controlled and (partly) owned by the original four partner airlines, respectively, as well as integrating a number of other national systems of further airlines. Amadeus operated on its own network Amanet, on various national networks and on the global SITA network, and, in 1994, claimed to have Europe's largest civilian database. Since Amadeus' foundation, the operation and marketing of the national Amadeus sub-systems have been conducted mainly by > 30 national marketing companies (NMCs) such as START Amadeus Vertrieb GmbH in Germany, and Amadeus Austria Marketing Ges.mbh in Austria, with SAS having also remained a national partner.

**Amadeus Global Travel
Distribution S.A.**
Madrid, Spain

Amadeus
(Amadeus Central System
and Amanet)

Amadeus Global Travel Distribution was formed in 1987, with each of the four European airlines Air France, Iberia, Lufthansa and SAS Scandinavian Airlines System owning equal shares. In 1991,

Figure 1
Evolutionary Development
of GDS Technology



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Amadeus (Amadeus Central System and Amanet)

Main National Distribution Systems (NDSs)	Esterel, France Savia, Spain Smart, Sweden START, Germany System One, North and Middle America	
Main Marketing Subsidiaries	Amadeus Austria Marketing Ges.mbH, Austria (founded in 1988; 25% Lufthansa Commercial Holding GmbH (Deutsche Lufthansa AG))	75%
	Amadeus Marketing (UK) Limited, England	100%
	Amadeus Marketing S.A., Spain	100%
	Amadeus Marketing S.A.R.L., France	100%
	Amadeus START Polska Sp.z.o.o., Poland (24.5% Orbis S.A., Poland, and 24.5% LOT Polish Airlines, Poland)	51%
	START Amadeus Vertrieb GmbH, Germany (95% START Holding GmbH)	5%
	START Hellas S.A., Greece	100%
	START Hungaria Kft., Hungary	100%
	START Seyahat Pazarlama A.S., Turkey (formerly START Turkiye S.A.)	100%
Information Technology Subsidiaries	Amadeus Data Processing GmbH & Co. KG, Germany (29.2% Lufthansa Commercial Holding GmbH (Deutsche Lufthansa AG))	70.8%
	Amadeus Development S.A., France	100%
	START Informatik GmbH, Germany (50% START Holding GmbH)	50%
Shareholders	Air France S.A., France	29.2%
	Continental Airlines, USA (Texas Air Group)	12.4%
	Deutsche Lufthansa AG, Germany (held via Lufthansa Commercial Holding GmbH (LCH), Germany)	29.2%
	Iberia Lineas Aéreas de España S.A., Spain	29.2%

Galileo International (Galileo Central System and Galileo International Distribution Network)

National Systems with Separate Names	Apollo Travel Services, North America, Mexico and Japan Galileo Southern Cross, Australia (founded in 1988; 100% Ansett Australia Airlines and Australian Airlines) Galileo UK, United Kingdom (formerly Travicom, Maidenhead/Berkshire, which was developed in 1977 by BEA and BOAC, the predecessor organisations of British Airways PLC) Sigma Travel System, Italy Traviaustria, Austria Traviswiss, Switzerland (developed in 1985; included Travitel for smaller travel agencies)	
Shareholders	Aer Lingus Irish Airlines, Ireland	0.10%
	Alitalia - Linee Aeree Italiane, Italy	8.71%
	Austrian Airlines + sterreichische Luftverkehrs AG, Austria	0.10%
	British Airways PLC, England	14.65%
	KLM Royal Dutch Airlines, The Netherlands	12.09%
	Olympic Airways, Greece	1.03%
	Swissair Schweizerische Luftverkehrs AG, Switzerland	13.22%
	TAP Air Portugal, Portugal	0.10%
	<i>(European airlines' share total)</i>	<i>(50%)</i>
	Air Canada, Canada	1.00%
	United Airlines Inc., USA (founded on 6 April 1926)	38.00%
	USAir Group Inc., USA	11.00%
	<i>(North-American airlines' share total)</i>	<i>(50%)</i>

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Until December 1994, Amadeus had its main presence in Europe, South America and Asia. In contrast, System One, which was owned by Continental Airlines and Eastern Airlines, and, after Eastern Airlines went bankrupt in 1989, wholly-owned by Continental Airlines, covered mainly the North and Middle American markets. System One became operational in 1982 and was based on PARS (programmed airline reservation system) technology, which was developed by IBM in 1964. Since 1991, System One has been co-operating with General Motors' subsidiary Electronic Data Systems Corporation (EDS), Dallas/Texas, USA. EDS' own data network, EDS-Net, has been supporting System One network since. In December 1994, Amadeus, Continental Airlines and EDS initiated a joint venture for the purposes of handling System One's marketing and software. The newly formed company System One Information Management LLC (formerly System One Corporation), Houston/Texas, USA, which was equally owned by the three partners, has since been operating as an NMC in North and Central America. The assets of the technical system of System One were acquired by Amadeus in April 1995, and the system was to be transferred onto the Amadeus Central System in Erding during 1996 and 1997 as part of the project Unison.

Galileo International Partnership

Rosemont and Chicago/Illinois, USA

Galileo International

(Galileo Central System and Galileo International Distribution Network)

The Galileo International Partnership was established in September 1993 (contractually in January 1993) by The Galileo Company Limited, Swindon/Wiltshire, England, and the Covia Corporation, USA, and combined the systems Apollo and Galileo. Since this merger, Galileo International has operated as Apollo in the United States, Mexico and Japan, and as Galileo in all other countries. The Galileo

Central System was located in Denver/Colorado, USA, and utilised its own Galileo International Distribution Network, its national networks as well as the global SITA network.

United Airlines introduced the Apollo system in 1971, based on IBM's PARS (programmed airline reservation system), which was developed in 1964 and further developed by Eastern Airlines. In 1976, United Airlines created the Apollo Services Division to manage the system Apollo and connected it to travel agencies. The division was separated into the subsidiary Covia Corporation in 1986. In July 1987, the Covia Corporation, together with the European airlines British Airways, KLM and Swissair, founded The Galileo Company Limited, also referred to as the Galileo Partnership. In August 1987, Alitalia and Austrian Airlines joined the Galileo consortium, followed by Aer Lingus and TAP Air Portugal in October 1987, Sabena Belgian World Airlines in February 1988, and Olympic Airways in March 1988. Sabena left the consortium in the early 1990's because of financial difficulties. In early 1988, the Covia Corporation was renamed Covia Partnership and its shares were acquired by United Airlines (50%) and USAir (12%) together with Alitalia, British Airways, KLM and Swissair (38% combined). The Galileo system, largely based on Apollo technology, became operational in 1989, combining the national reservation systems of the various partner airlines such as Corda in The Netherlands, Sigma Travel System in Italy, Travicom in the United Kingdom, Traviaustria in Austria, and Traviswiss in Switzerland. The name Corda was used thereafter only for the KLM internal airline system, and Travicom was renamed Galileo UK.

The Gemini Group was founded in Canada in November 1988 by Air Canada, Canadian Airlines International Limited (formerly Canadian Pacific) and the Covia Corporation (Covia Partnership), integrating Air Canada's Reservac system, which

was installed in 1978, and Canadian Airlines International's Pegasus system, which was installed in 1979. While Canadian Airlines International later left the group, Air Canada became a co-owner of the Covia Corporation, and the Gemini system was re-designed based on Apollo technology in 1989 and finally integrated into Apollo in July 1994.

Since Galileo's foundation, the operation and marketing of the national systems has mainly been handled by national distribution companies (NDCs). 46 NDCs existed in November 1994 worldwide, including those of the partner airlines and those of Inter Globe Enterprises in India since September 1994, South African Airways (SAA) in South Africa since April 1992, and Turkish Airlines Inc. (Türk Hava Yollari A.O.) in Turkey since the end of 1994.

The SABRE Group

Dallas/Texas, USA

SABRE

(SABRE Travel Information Network)

In 1951, the project SAGE (semi-automated ground environment) was set up by International Business Machines Corporation (IBM) on behalf of the United States Air Force with the aim of developing a real-time computer system for air traffic control. Based on the knowledge gained from this defence project, American Airlines Inc. together with IBM initiated the project SABER (semi-automated business environment research) in 1953 (1959) to develop an inventory system for American Airlines, becoming operational as the first airline computerised reservation system (CRS) in the world in 1963. With the initial project being completed and IBM going separate ways from American Airlines, the system was renamed SABRE (semi-automated business research environment) in 1964. SABRE was made available to travel agents in 1976, and the first SABRE terminals were installed in Europe in 1985. The compu-

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SABRE (SABRE Travel Information Network)

Major Divisions	SABRE Computer Services (SCS), USA SABRE Distribution Services, USA (founded in 1988) SABRE Europe, England (founded in 1995; managed Europe, Africa, and the Middle East) SABRE Interactive, USA (founded in mid 1995 to investigate direct consumer systems) SABRE Travel Information Network (STIN), USA
Joint Ventures and Other Alliances	Axess (Axxess), Japan (built in 1991; based on JALCOM (developed in 1988); 75% Japan Airlines (JAL) and 25% AMR Corporation (acquired in 1995)) Falcon Information Network, Arab countries (100% Gulf Air) Fantasia, Far East Asia (built in 1989; 100% Qantas Airways Limited) SITAR, India (100% Air India and Indian Airlines) Zenon, Cyprus (100% Cyprus Airways Limited)
Shareholders	AMR Corporation, USA (also owned 100% of American Airlines Inc. and 33% of Canadian Airlines International Limited; planned to float 20% of SABRE on the stock exchange in late 1996 / early 1997) 100%

Worldspan (Worldspan Global Travel Information Services)

National Distribution Systems (NDSs)	Abacus, Asia Infini, Japan (established in 1990, based on system Able; 100% All Nippon Airways & Co. Limited (ANA))																				
Shareholders	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">Abacus Distribution Systems PTE Limited, Singapore</td> <td style="text-align: right;">5%</td> </tr> <tr> <td>Delta Air Lines Inc., USA</td> <td style="text-align: right;">38%</td> </tr> <tr> <td>Northwest Airlines Inc., USA</td> <td style="text-align: right;">32%</td> </tr> <tr> <td>Trans World Airlines Inc. (TWA), USA</td> <td style="text-align: right;">25%</td> </tr> </table>	Abacus Distribution Systems PTE Limited, Singapore	5%	Delta Air Lines Inc., USA	38%	Northwest Airlines Inc., USA	32%	Trans World Airlines Inc. (TWA), USA	25%												
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Shareholders of Abacus in 1994	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">All Nippon Airways & Co. Limited (ANA), Japan</td> <td style="text-align: right;">13.5%</td> </tr> <tr> <td>Cathay Pacific Airways Limited, Hong Kong (25% state-owned CITIC Pacific Limited, China, 43.9% Swire Pacific, 30.1% others)</td> <td style="text-align: right;">13.5%</td> </tr> <tr> <td>China Airlines Limited, China</td> <td style="text-align: right;">13.5%</td> </tr> <tr> <td>Hong Kong Dragon Airlines Limited (Dragon Air), Hong Kong (25% Cathay Pacific Airways Limited, and 35.86% state-owned China National Aviation Corporation Limited (CNAC), China)</td> <td style="text-align: right;">2.0%</td> </tr> <tr> <td>Malaysia Airlines, Malaysia</td> <td style="text-align: right;">13.5%</td> </tr> <tr> <td>Philippine Airlines, Philippines</td> <td style="text-align: right;">10.0%</td> </tr> <tr> <td>Royal Brunei Airlines, Brunei</td> <td style="text-align: right;">13.5%</td> </tr> <tr> <td>SilkAir (Singapore) PTE, Singapore</td> <td style="text-align: right;">2.0%</td> </tr> <tr> <td>Singapore Airlines Limited (SIA), Singapore</td> <td style="text-align: right;">13.5%</td> </tr> <tr> <td>Worldspan Services Limited, England <i>(EVA Airways Corporation and Garuda Indonesia joined in 1995.)</i></td> <td style="text-align: right;">5.0%</td> </tr> </table>	All Nippon Airways & Co. Limited (ANA), Japan	13.5%	Cathay Pacific Airways Limited, Hong Kong (25% state-owned CITIC Pacific Limited, China, 43.9% Swire Pacific, 30.1% others)	13.5%	China Airlines Limited, China	13.5%	Hong Kong Dragon Airlines Limited (Dragon Air), Hong Kong (25% Cathay Pacific Airways Limited, and 35.86% state-owned China National Aviation Corporation Limited (CNAC), China)	2.0%	Malaysia Airlines, Malaysia	13.5%	Philippine Airlines, Philippines	10.0%	Royal Brunei Airlines, Brunei	13.5%	SilkAir (Singapore) PTE, Singapore	2.0%	Singapore Airlines Limited (SIA), Singapore	13.5%	Worldspan Services Limited, England <i>(EVA Airways Corporation and Garuda Indonesia joined in 1995.)</i>	5.0%
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Société coopérative (SITA)

Main Subsidiaries	Integrated Telecommunications Solutions (ITS), USA (founded in 1972) 100% Novus, USA (acquired in 1993) 70% SITA Telecommunications, USA (founded in 1995, integrating Scitor Globetel (founded as Scitor in 1990); US bank Morgan Stanley acquired 30% in October 1995; provided global telecommunications services to non travel and tourism customers) 70%
Shareholders	550 airlines and air transport related companies (at the end of 1995) (The number of non-airline members had increased over the years and included airport authorities, aircraft and engine manufacturers, travel organisations and the three GDSs Amadeus (including System One and START), Galileo International, and Worldspan (including Abacus).)

ter system was located in Tulsa/Oklahoma, USA. SABRE operated its own distribution network in the USA and used SITA's elsewhere.

Worldspan Services Limited
Hayes/Middlesex, England

Worldspan
(Worldspan Global Travel Information Services)

Worldspan Global Travel Information Services was created on 7 February 1990 through the merger of the system PARS by Northwest Airlines and Trans World Airlines (TWA) with the system DATAS II by Delta Air Lines and the linking of the Abacus system by Abacus Distribution Systems. However, it took until 1993 for the PARS Service Partnership (PSP) and PARS Travel Information Systems (PTIS), Kansas City/Missouri, to be fully integrated into Worldspan. Worldspan's data centre was located in Atlanta, USA, and ran on an X.25 network, which was managed by AT&T and its European subsidiary AT&T Istel.

PARS (programmed airline reservation system), which was first developed by IBM in 1964 and then further developed by Eastern Airlines, was introduced by TWA in 1976, replacing its internal reservation system, which had been developed in 1971.

In 1986, Northwest Airlines acquired 50% of TWA's PARS, and PTIS and PSP were formed. DATAS II, based on IBM's original PARS technology, was introduced by Delta Air Lines in 1982, later replacing its internal system, which was created in 1968. Abacus was founded in 1987 by Cathay Pacific Airways, Singapore Airlines and Thai Airways International PLC. Thai Airways International later dropped out of the partnership, while other airlines joined. In 1988, PARS and Abacus signed an agreement to create a global system, thus laying the foundations for Worldspan.

Société Internationale de Télécommunications Aéronautiques

Société coopérative (SITA)
Bruxelles, Belgium

SITA was founded as a co-operative organisation in 1949, serving the telecommunication needs of the international airline sector. In 1995, SITA owned and operated the world's largest international data network, providing 40,000 user connection in > 213 countries and territories. (SITA's system was temporarily called Gabriel Extended Travel System (GETS). Amadeus, Galileo International, SABRE and the commercial on-line service provider CompuServe, among others, utilised SITA's network to supplement their own.

Source

*Kärcher, K. (1996; forthcoming).
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