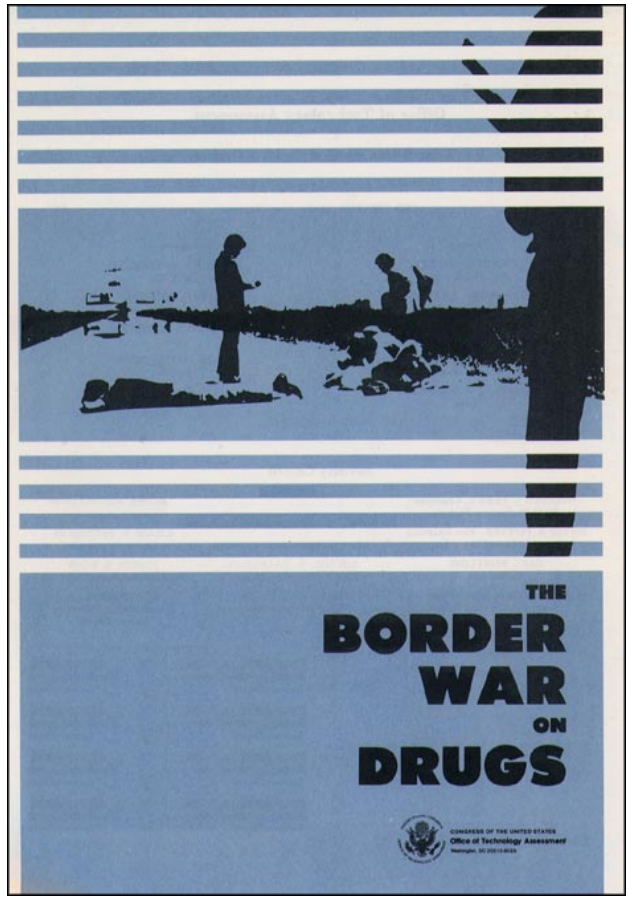
The Border War on Drugs

March 1987

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Foreword

Smuggling of illegal drugs into the United States is a problem of serious proportions. The three major drugs of foreign source—cocaine, heroin, and marijuana-are the products traded by an enormous criminal enterprise whose retail sales total approximately $50 billion annually. Federal efforts to stop or deter international narcotics trafficking have met with only limited success.

The Office of Technology Assessment was requested by the Senate Committee on Appropriations to conduct an analysis of Federal drug interdiction efforts and to report on technological opportunities for future improvements. The study characterizes the drug smuggling problem and the interdiction efforts now in place within the responsible Federal agencies. It describes technologies in use, under development, and potentially available for countering smuggling by the various modes—private vessels, private aircraft, land vehicles, commercial carriers, and through official ports of entry. The report also highlights OTA's principal findings, focusing on: the need for comprehensive design of integrated technological systems, the need for long-range planning for employing technologies, the need for integrated strategies, and the need for data and methods to measure effectiveness.

There are many issues that this OTA study did not cover because they were considered either outside the boundary of the congressional request or beyond the scope of the study given the OTA resources devoted to it. Among the issues not examined are: the demand side of the drug problem; international initiatives to control production; investigation and prosecution of drug traffickers; domestic production and distribution of drugs; civil liberty concerns about law enforcement activities; impacts of drug law enforcement on legitimate commerce or private use of border areas. Even though not covered in this study, these issues are important and must be considered when formulating sound public policy.

OTA is grateful for the considerable assistance provided during the conduct of this study by our advisory panel, an agency advisory group, numerous other contacts within the several Federal agencies, and a number of additional consultants or advisors. These individuals have made it possible for OTA to use comprehensive, accurate, and current information in analyzing this complex subject with numerous Federal entities. They have also enabled OTA to examine the problem from a number of important perspectives. We appreciate the help and advice from all these individuals.



JOHN H. GIBBONS
Director

Advisory Panel—Border War on Drugs Project

Don Kash, ***Chairman***
George Lynn Cross Research Professor
University of Oklahoma

Myles J. Ambrose, Esq.
O'Connor & Hannan
(Former U.S. Commissioner of Customs)

William J. Coffey
Associate General Counsel
Sealand Corp.

Thomas R. Evans
Applied Physics Laboratory
The Johns Hopkins University

Derwood Hall
Facilities Management Division
NY/NJ Port Authority

Roy Kaaa
Assistant Chief
Honolulu Police Department

John L. McLucas
President
QuesTech, Inc.

Timothy J. Millhouse
Consultant
(Former Director, Customs Air Operations West)

Mark F. Mispagel, Esq.
Gatzke & Mispagel

Frank Monastero
Consultant
(Former DEA Chief of Operations)

Arthur F. Nehrbass
Commander, Organized Crime Bureau
Metro-Dade Police Department

Admiral William Stewart
U.S. Coast Guard, Retired
(Former Coast Guard District Commander)

OTA Project Staff—Border War on Drugs

John Andelin, ***Assistant Director, OTA***
Science, Information, and Natural Resources Division

Robert Niblock, ***Oceans and Environment Program Manager***

Peter Johnson, ***Project Director***

Joan Ham, ***Analyst***

Larry Jenney, ***Senior Analyst***

Daniel Kevin, ***Analyst***

Elizabeth Keyes, ***Senior Analyst***

Stan Kolar, ***Research Assistant***

Administrative Staff

Kathleen Beil

Jim Brewer

Contents

Page

Summary 1
Key Findings 3
Goals and Options 4
Purpose of This Study. 7
The Drug Problem 9
Sociopolitical Impacts of Smuggling. 9
Trends 10
The War on Drugs. 17
The Drug Trafficking System 19
Production and Processing 19
Transport 19
Domestic Distribution and Marketing 19
Recycling Revenues 20
Noninterdiction Options 20
Smuggling Activities. 23
Transport Modes 23
Drug Trafficking Organizations 27
Enforcement Organizations. 33
Drug Enforcement Administration. 33
Federal Bureau of Investigation 34
Coast Guard 34
Customs Service 35
Border Patrol.. 37
Support Agencies 37
Department of Defense 38
Federal Aviation Administration 38
State and Local Enforcement Agencies 38
Coordination Organizations 39
Interdiction Technologies 41
Generic Limitations 41
Intelligence. 41
Command and Control 43
Surveillance 44
Pursuit and Capture. 46
Detection at Ports of Entry... 48
Findings 51
Inadequate Direction 51
Data Deficiencies 52
Coordination Problems 52
Technological Limitations 53
Appendix A—Anti-Drug Abuse Act of 1986, OTA Selected Summary of Interdiction Provisions 59
Appendix B—Acknowledgments 61

Contents—continued

Tables

Table No.		*Page*
I.	Total Drug Traffic Revenues	9
2.	1985 Drug Prices	9

Figures

Figure No.		*Page*
1.	Total Cocaine Traffic, 1981-86	11
2.	Cocaine-Related Emergency Room Visits, 1981-85	11
3.	Cocaine Production, Traffic, and Consumption, 1981-85	12
4.	Cocaine Wholesale Prices in Miami and Nationwide, 1981-86	13
5.	Total Marijuana Traffic, 1981-86	14
6.	Total Heroin Traffic, 1981-86	15
7.	Heroin Smuggling Routes From Source Areas to the United States	24
8.	Cocaine Smuggling Routes From Latin America to the United States and Europe	25
9.	Marijuana Smuggling Routes From Latin America and the Caribbean to the United States	26
10.	Estimated Illegal Drug Gross Income to the Smuggler by Country or Region, Calendar Year 1985	29
11.	Interdiction Functions	42

SUMMARY

Despite a doubling of Federal expenditures on interdiction over the past 5 years, the quantity of drugs smuggled into the United States is greater than ever. Illegal imports of cocaine, the drug now of intense national concern, have about doubled since 1981, supplying a growing number of users at prices that have fallen as the supply has increased.

The challenge faced by drug enforcement agencies is formidable. OTA estimates that U.S. retail sales of marijuana, cocaine, and heroin totaled about $50 billion in 1985. A survey taken at that time indicated that 18.2 million Americans used marijuana once or more a month and 5.8 million were monthly users of cocaine. Overall, 10 percent of the population over age 12 were found to be monthly users of marijuuana and 3 percent monthly users of cocaine. Other data indicate that 500,000 persons in this country use heroin regularly.[1]

The large market, coupled with the huge profits to be made by transporting drugs from foreign suppliers to domestic wholesalers, fuels this illegal traffic. OTA estimates that the mark-up between foreign and domestic wholesale prices is on the order of 20 to 30 times for marijuana, 4 to 5 for cocaine, and 30 to 40 for heroin. In 1985, the value added to the product through smuggling was roughly $6 billion for marijuana, $1.6 billion for cocaine, and $1 billion for heroin. Of this, perhaps 90 percent (over $7 billion) was realized as profit by drug smugglers.

The drug traffic moves by a great variety of transport modes and routes to reach the United States. Most imported marijuana comes either by sea in private vessels or by land across the Mexican border, but private aircraft and commercial

WHAT IS INTERDICTION?

In this study, *interdiction* refers to efforts to intercept or to deter the shipment of illegal drugs (chiefly marijuana, cocaine, and heroin) from foreign countries to the United States. It does not include actions in source countries to reduce cultivation or to disrupt drug-trafficking organizations responsible for processing and shipment. Neither does it include actions to pursue and to neutralize drug trafficking organizations and distribution networks within the United States, although all these actions are part of the overall Federal strategy to combat drug use. Interdiction focuses on drugs in transit to the U.S. border, including both those shipments concealed in legitimate commerce that seek to pass through ports of entry and those that attempt to penetrate the border surreptitiously in private aircraft, boats, and land vehicles or carried by persons on foot.



Photo credit: U.S. Coast Guard

[1]The number of regular marijuana users and heroin addicts has been reported in the annual Narcotics Intelligence Estimate published by DEA and in the most recent (June 1986) DEA Special Report, "Worldwide Drug Assessment. Estimates of heroin addicts are based on a 1981 survey. Marijuana usage is based on 1982 and 1985 NIDA "Household Surveys," The 1985 National Household Survey on Drug Abuse published by the National Institute on Drug Abuse puts the number of regular cocaine users at about 5,800,000. Total U.S. consumption of cocaine appears to have increased 20 to 30 percent from 1982 to 1986. Some researchers believe that the number of users may not be growing as much as the incidence of very heavy usage. In addition, the 1985 University of Michigan survey of high school students states that cocaine use by high school seniors was at an all time high (17 percent have tried cocaine) and that this would indicate increased use among that group in the future. Highlights of the 1985 Household Survey are appended to this report.

transport are also used. Cocaine is smuggled across all three coasts and the Mexican border, with about half the traffic carried in private aircraft and a large share of the remainder in private vessels. The amount of cocaine smuggled through ports of entry appears to be increasing. The heroin produced in Southeast and Southwest Asia is primarily carried by airline passengers through ports of entry or hidden in cargo or mail. An increasing amount of Mexican heroin enters across the land border. Smugglers show great ingenuity in devising methods of entry. When interdiction efforts restrict a particular mode of transport or route, drug traffickers quickly shift to alternatives. As a result, the Nation's long and highly permeable borders are being assaulted by an illegal traffic that uses all conceivable means of transport and concealment.

The agencies with primary responsibility for drug interdiction are the Customs Service and the Coast Guard. The Customs Service is charged with combating smuggling by private aircraft, by private vessels in near-shore waters, and by all modes at ports of entry. The Coast Guard shares responsibility with Customs for interdiction of seaborne drug traffic near shore and conducts patrols along the entire U.S. coastline and in the open ocean, focusing on the Gulf of Mexico and the Caribbean Sea. Along the Mexican border between ports of entry, the Border Patrol of the Immigration and Naturalization Service exercises enforcement effort as an adjunct to its primary mission of preventing illegal immigration.

These front-line agencies, supported by numerous other Federal agencies, have seized increasing quantities of drugs over the past 5 years. In fiscal year 1986, almost $800 million was expended by the Federal Government in this effort. Despite these efforts only a small percentage of drugs are being seized and the flow of drugs into this country has not yet been stemmed. (Seizure rates vary according to the particular drug, the season of the year, locale, and mode of transport.)

The Anti-Drug Abuse Act of 1986 (Public Law 99-570) affirms the role of interdiction as an important element in drug law enforcement. The act authorizes a substantial increase in funding for interdiction resources and personnel and greater use of military assets. It also sets the stage for resolving some of the fragmentation in organization and responsibilities for drug interdiction (e. g., between Coast Guard and Customs). It establishes mechanisms for allocating new military equipment and the requirement for legislative proposals from the President by mid-1987 to reorganize executive branch efforts to combat drug trafficking and abuse.

The goal of the Nation's overall anti-drug abuse program is to reduce the number of users and prevent others from becoming users. The national strategy includes many elements of both supply and demand reduction. Interdiction is only one element of supply reduction, which also includes investigation and prosecution, and international narcotics control. While many debate the relative merits of each of these elements, most agree that some level of effort in each is necessary.

Central to the success of future drug interdiction efforts are the technologies employed to detect, intercept, and capture smugglers. This study investigates the availability, use, and performance of the technologies now used for this and others that could contribute to the Nation's effort to prevent illegal drug traffic. Understanding the present contribution and potential improvement of these technologies involves not only examination of the technologies themselves but also the organizations that use these systems and the enforcement strategies they employ.

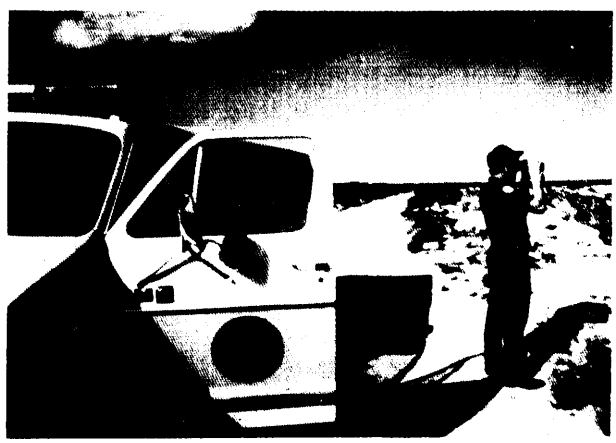


Photo credit: Border Patrol

The Border Patrol has recently been given authority to perform drug interdiction along the 2,000-mile Mexican border but law enforcement coverage is **sparse.**

Key Findings

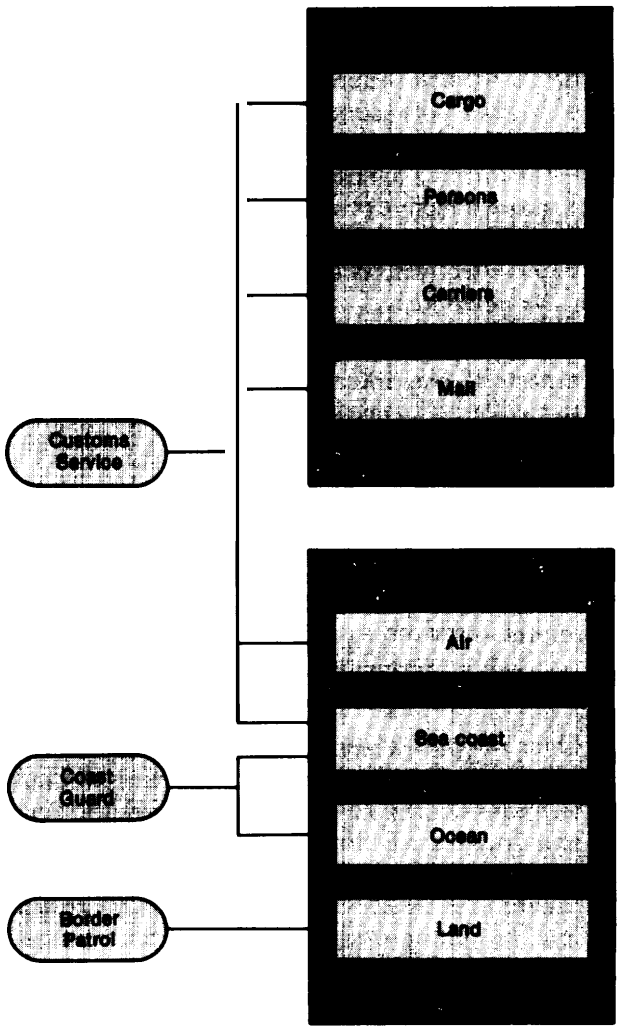
1. Despite increasing Federal expenditures for interdiction, illegal drug imports appear to be increasing. There is no clear correlation between the level of expenditures or effort devoted to interdiction and the long-term availability of illegally imported drugs in the domestic market. However, given the profitability of drug smuggling, a worldwide glut of **drugs, and the** view that the United States is the favored market for drugs, interdiction alone will probably never result in more than a short-term or relatively small reduction in drug availability.

2. OTA found the Federal agencies charged with the responsibility of drug interdiction to be staffed by dedicated and vigorous personnel who demonstrate courage and imagination m carrying out their responsibilities. For the most part, however, they have had to operate with very limited technological resources. The size, scope, and diversity of the smuggling challenge is enormous compared to the human and equipment resources that front-line enforcement agencies can bring to bear.

3. Data on drug smuggling, the trafficking system, and interdiction activities are inadequate for effective planning and management. Such data are needed to make informed selection of best strategies, to allocate enforcement resources, and to guide the design and management of interdiction programs. Measures of effectiveness for interdiction are difficult to define precisely. The numbers and quantities of drug seizures are difficult to interpret without good knowledge about smuggling attempts. Often, intelligence reports provide the best information on the effect of interdiction efforts on smuggling activity.

4, Responsibilities of the Federal drug interdiction agencies are fragmented and overlapping. The lack of a suitable institutional framework is a major impediment to the adoption and effective use of technologies, particularly command and control systems that could offer significant benefits. With the exception of special intensive operations, problems with interagency coordination and cooperation occur and no central authority addresses important strategic questions on priorities and resource allocation.

Roles of Drug Interdiction Agencies



SOURCE: Office of 1'echnology Assessment, 1987.



Photo *credit: U.S. Customs Service*

5. Lack of an overall direction that would establish a comprehensive approach to planning and operations, limits the effectiveness of interdiction programs. Improved direction could enable:
   —enforcement resources to be allocated to the highest priority problems;
   —the various agencies to design and carry out more effective coordinated interdiction strategies; and
   —the effectiveness of interdiction programs to be evaluated.

6. The value of intelligence is very high for all aspects of drug interdiction. In particular, good tactical intelligence can mean a large increase in ability to identify smuggling attempts. In certain areas, intelligence gathering is limited by inadequate resources and an ineffective network. Needed information cannot be gathered and delivered to the users in a timely fashion. Classified intelligence, even if valuable to interdiction efforts, is not often or easily used because of concerns about revealing sources and methods during court proceedings.

7. Over the past 2 years many new technologies, ranging from remote sensors to pursuit aircraft and patrol boats, have been introduced into Federal drug interdiction programs. These technologies have, for the most part, enhanced Federal capabilities. However, the technologies are just now becoming operational and evaluations of their overall effectiveness cannot be made without more experience and a directed effort to collect relevant data for evaluation.

8. No single technology has been identified that by its addition would solve the Nation's overall drug interdiction problem. But there are many opportunities for individual technologies to make incremental contributions to specific Federal interdiction efforts. Realizing these opportunities may require development of new technologies or procurement of increased numbers of existing technologies. However, most technological improvements, by themselves, may have only a temporary benefit because, based on the record, the drug traffickers will take rapid and usually successful actions to neutralize the effectiveness of new interdiction techniques.

9. There is a serious lack of support for research, development, test, and evaulation of new or transferred technologies within all of the drug interdiction agencies. Opportunities exist within other Federal agencies (especially the national laboratories and Department of Defense (DOD) laboratories) to provide some of the needed capabilities.

Goals and Options

Even though goals for the national drug interdiction program are seldom stated explicitly, it appears that three major objectives make up the implicit working goals of all of the agencies involved. These are:

1. to constantly harass and deter smuggling attempts by significant modes and at key locations and to work toward disrupting the trafficking networks, seizing as many drugs as possible, and making arrests of the drug traffickers;
2. to force the most vulnerable drug trafficking organizations out of business; and
3. to demonstrate a national resolve to curtail the d g b p b m



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While these goals do not lead to specific measures of effectiveness, it may be useful to consider how well the technologies, agencies, and programs are directed toward them.

Operationally, the above goals have been used by each interdiction agency to develop strategies that are reasonably consistent with each other. OTA's investigation has concluded that at least three elements are vital to such strategies:

1. to apply constant pressure on drug traffickers operating wherever intelligence or experience indicates that significant activity takes place;
2. to constantly monitor trafficking patterns and smuggling attempts to direct interdiction pressure; and
3. to conduct limited duration special operations that cause exceptional problems, costs, or risks for the traffickers.

OTA has found that the front-line interdiction agencies, in general, use these strategies implicitly, if not explicitly, in their day-to-day operations. And, these strategies can fulfill the national goals. For example, constant pressure fulfills the general harassment goal; constant monitoring can direct that pressure to maximize seizures and arrests; special operations can force out the vulnerable organizations and also produce quick successes that contribute to demonstrating national resolve.

Congress passed the Anti-Drug Abuse Act of 1986 (Public Law 99-570) in October 1986. Several provisions of the act are directed at enhancing Federal interdiction efforts conducted by the Drug Enforcement Administration (DEA), the Coast Guard, and the Customs Service as well as those supported by DOD and other agencies. The interdiction agencies, therefore, can benefit from a unique opportunity to allocate new resources and redirect existing ones to meet the objectives of the bill. Other provisions provide the opportunity to reallocate agency responsibilities and provide direction. For example, the Coast Guard may assume a greater role in the air interdiction mission. The National Drug Enforcement Policy Board is charged with making decisions about such changes in the missions.

This OTA assessment of interdiction technologies suggests a range of options that could be employed by the Federal agencies in an effort to improve the effectiveness of future operations, increase success within their operational strategies, and make more efficient use of resources. These options are listed below:

- The principal interdiction agencies, under the direction of the National Drug Enforcement Policy Board, the National Narcotics Border Interdiction System, or another central authority, could prepare a coordinated long-range plan for deployment of interdiction resources and technologies to apply pressure on major smuggling modes at ports of entry and air, marine, and land borders. This would entail matching resources to the present threat and developing a system to assure that consistent monitoring of trafficking is fed into the planning process. The plan could include networks for intelligence and surveillance data as well as designated commands for specific arenas. OTA has noted throughout its report deficiencies in information and command networks and has stressed centralized planning.
- Establish a system and standards common to all agencies which would be used to evaluate deterrent capabilities and the effectiveness of technologies and techniques used for interdiction. The system would need to include specified data to be collected, standards for measuring detection and apprehension rates, consistent costing methods, and procedures for using the most appropriate data to evaluate systems or operations.
- For the port of entry interdiction problem, the Customs Service or another agency could establish a substantial R&D program to develop more effective detection technologies. OTA has found that there is some promise of technological advancement in this area but R&D efforts are too small to conduct needed work. Existing National laboratories could provide the technical base for a major R&D effort. OTA has made suggestions for specific program elements in later sections of this report.

- For illegal border entry interdiction (air, marine, and land), a cooperative agency group could design a border surveillance-detection network for smuggler traffic. OTA has found that sufficient technologies (mostly military) are available to address this problem, but that a design for deployment is lacking. An OTA suggested approach is contained in other sections of this report.

PURPOSE OF THIS STUDY

This report deals with one component of the Nation's war on drugs—specifically, the effort to interdict drugs en route to or across the Nation's borders. More than half the recent Federal expenditures on drug law enforcement are devoted to interdiction. OTA estimates that in Fiscal Year 1986 drug interdiction expenditures amounted to almost $800 million. The Anti-Drug Abuse Act of 1986 (Public Law 99-570) and a number of Administration proposals will substantially increase this number.

The precise effect of the present interdiction effort is difficult to determine, but interdiction plays a significant role in the national strategy to combat drug abuse. For example, interdiction can deter at least some inexperienced smugglers and, when seizures result, subsequent investigations may lead to the break-up of smuggling organizations. However, given the worldwide glut of drugs and the expert view that the United States is the favored market for drugs, interdiction alone will probably never result in more than a short-term reduction in drug supply.

This study is concerned with the availability, performance, and use of technologies that can contribute to the interdiction effort. Thus, this study focuses major attention on the technologies available and the Federal organizations that use those technologies and their strategies. The procurement and operation of technologies used to support drug interdiction represent the largest share of Federal expenditures aimed at the prevention of smuggling. This study investigates the range of choices among technologies and the alternative ways of using those technologies.



THE DRUG PROBLEM

Illegal drug trafficking and use in the United States is a problem of major size and scope. Although the illegal drug network now reaches every area of the Nation and all strata in society, the hard data necessary to provide a precise and complete description of the Nation's drug problem are not available. Drug data are fraught with uncertainty for a simple reason. They are data about and derived from a system that is part of the underworld. Drug traffickers and users devote great efforts to staying hidden.

This report does, however, attempt to characterize the size and impact of the Nation's drug problem by drawing on publicly available information and Federal agency estimates. Many of the numbers are constructed from limited data, so OTA generally gives them as ranges.

Illegal drugs are classified by the Controlled Substances Act into four categories: 1) cannabis (e. g., marijuana and hashish); 2) cocaine; 3) dangerous drugs (e. g., methamphetamine, LSD, methaqualone, and amphetamines); and 4) opiates (e. g., heroin). The size of the illegal economy supported by the three drugs (marijuana, cocaine, and heroin) that are the focus of this study (because they are mostly or entirely imported) are estimated by OTA to have had an annual gross retail value in 1985 of about $50 billion (see tables 1 and 2). Thus, the retail sales of marijuana, cocaine, and heroin equal the combined sales of the Nation's two largest retailers, Sears and K-Mart. Unlike Sears and K-Mart, the drug industry requires small capital investment, involves no retail stores, and minimal investment in production and storage facilities. The industry's major operating costs are associated with paying employees and supporting the illegal transportation network that is the focus of this study.

The DEA states that the rate of drug use in the United States is higher than any other Western industrialized country. Marijuana is the most widely used illegal drug with an estimated 18.2 million Americans using it one or more times each month. As many as 5.8 million Americans use cocaine one or more times a month and there are estimated to be a half million heroin addicts.[2] In sum, 10 percent of the population over the age of 12 are regular users of marijuana and 3 percent are users of cocaine.

Table I.—Total Drug Traffic Revenues
(1985 gross averages in U.S. billions of dollars)

	Foreign wholesale	Domestic wholesale	Retail
Marijuana	$0.4	$6.3	$16.8
Cocaine	1.2	2.8	20.0
Heroin	—	1.0	13.8
Total.	$1.6	$10.1	$50.6

NOTE: These data were derived from the 1985 Worldwide Drug Assessment prepared by DEA and 1985 National Average Prices also developed by DEA. The averge of the high and low estimates for import weight of each drug was multiplied by the average of the high and low price to obtain the above estimates of gross revenue. The estimates represent only those drugs that were imported and consumed in the United States. Such portions that were stockpiled, lost, seized, or domestically produced have been deducted from these figures These data could be very inaccurate but these are the most reliable figures OTA could obtain

Table 2.—1985 Drug Prices
(U.S. **dollars per pure kilogram)**

	Foreign wholesale	Domestic wholesale	Retail
Marijuana (national average). . . .	35	990	2,625[a]
Cocaine:			
(national average). . . .	9,000	40,000	285,000[b]
(Miami)	–	30,000C	—
Heroin	4,500	160,000	2,300,000[d]

[a]Colombian marijuana purchased in small quantities.
[b]purchased in small quantities at 35 PerCent purity.
[c]First half of 1986 cocaine prices in Miami ranged from $20,000 to $32,000.
[d]Purchased in small quantities at 5 percent purity.

SOURCE: Drug Enforcement Administration and Metro-Dade Police Department.

Sociopolitical Impacts of Smuggling

The above statistics tell only part of the story. Another dimension is the impact of the trafficking system itself. Virtually all heroin and cocaine and about 80 percent of the marijuana consumed are smuggled across our borders. The social, economic, and political consequences of this huge industry are negative and serious.

The international drug trade is considered so dangerous that in April 1986 the President signed a National Security Decision Directive on Narcotics and National Security, and directed Federal agencies including the Department of Defense to more actively counter narcotics smuggling.[3] A major fo-

[2]Ibid.

[3]Testimony of Colonel Harvey G. Pothier, USAF, Acting Director of DOD Task Force on Drug Enforcement, before the Subcommittee on Defense, Senate Committee on Appropriations, July 30, 1986.

cus of concern has been the effect of drug revenues in corrupting political and judicial institutions worldwide. Growing evidence suggests that many political leaders, police officials, and judges provide protection for drug smugglers in exchange for bribes. In more extreme cases, political, military, and police officials are themselves active participants in the international drug trade.

Where the officials involved are members of friendly governments, the dilemmas posed for U.S. foreign policy are evident. U.S. efforts to crack down on the drug trade may result in destabilizing the Nation's allies.

Domestically, the range of impacts resulting from the drug trade is reported daily in the news media. The highly publicized deaths of college and professional athletes reflect a growing awareness of cocaine abuse. More generally the increase in drug abuse has led the commissioners of professional baseball and football to establish drug testing programs. Similarly, many corporations have become so concerned about drug use among their employees that they plan to require drug tests as well. Testing of U. S. military personnel over the past 5 years has apparently led to dramatic declines in the number of users in the services.

In recent years a growing number of major U.S. banks have been fined for their failure to report large cash transactions. The suspicion is that some of these large cash transactions involve the laundering of drug money. Whether the failure to report large cash transactions is conscious or inadvertent, they reflect the pervasive nature of the drug economy.

The President's Commission on Organized Crime believes that drug trafficking is the most widespread and lucrative organized crime activity in the Nation, accounting for almost 38 percent of all organized crime cases.[4] Drugs have not only become a major activity of long-established criminal organizations, but have also led to the establishment of a growing number of newly organized crime families. Criminal organizations dominated by Latin Americans and Asians are now commonly identified. As these criminal organizations develop and mature, they grow ever more sophisticated. With this sophistication comes, all too frequently, efforts to corrupt U.S. political, police, and judicial officials. One member of this study's advisory committee said: "There is an old adage that everyone has his price. The drug traffickers have the revenues to pay that price.

[4]Report of the President's Commission on Organized Crime, Washington, DC, March 1986.

Trends

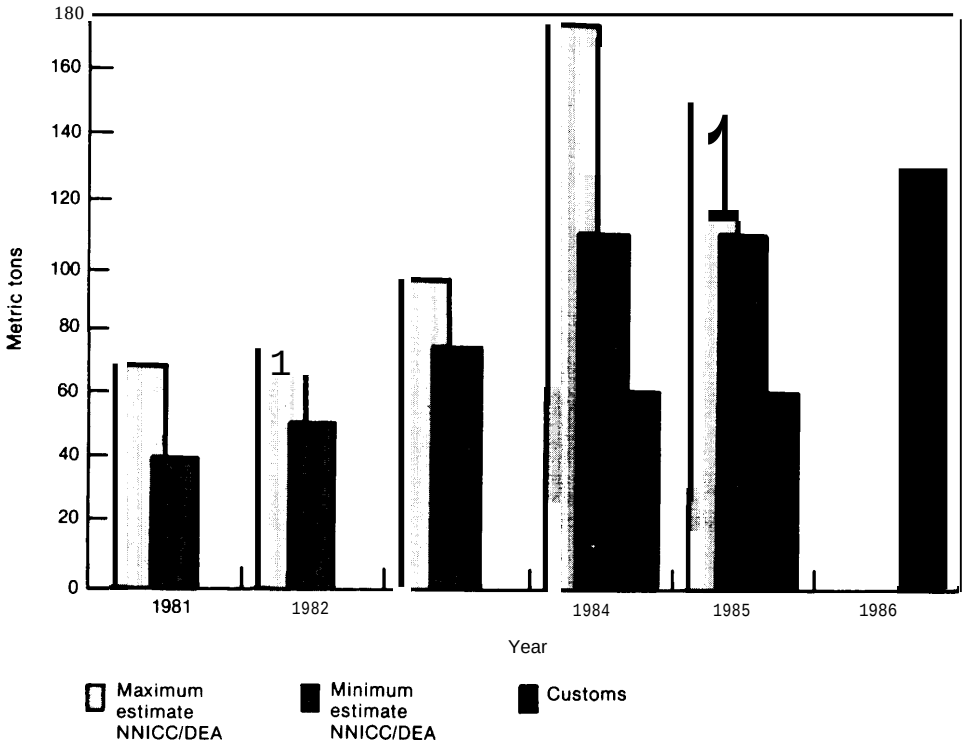
Data on the size and character of the drug trafficking system are not reliable. For the most part, estimates of the quantity of drugs being smuggled are derived from data on seizures by drug enforcement agencies. Seizure data from a given agenc~ are often inconsistent and comparison of seizure data from different agencies regularly highlights gross contradictions. Some of the inconsistency is due to double counting, inaccurate weighing, and the existence of several different, separate data systems set up by the agencies involved. A quantitatively reliable picture of trends is not currently available. A new system to eliminate double counting among agencies began operating in October 1986. However, this improvement will not provide information necessary to evaluate effectiveness of individual program elements. Neither can it provide meaningful information about trends until enough data is acquired (perhaps in a year or two).

Even the most conservative estimates of the quantities of drugs coming into the United States are cause for major concern. It also appears that the illegal drug networks will continue to seek market expansion. The drug trafficking system has evolved a level of professionalism that allows it to respond to the market with a speed and sophistication equal to or greater than that of many legitimate industries. Both the volume of drugs available and the forms of sale are flexible.

In terms of retail sales the total dollar value of cocaine is second to marijuana, but DEA views cocaine as the country's most serious drug problem, because of its widespread use, increasing availability and significant health consequences. DEA believes that this will remain the case for the foreseeable future.[5]

[5]U. S. Department of Justice, Drug Enforcement Administration, *Special Report: Worldwide Drug Assessment: Threat to the United States,* June 1986, p. 2.

Figure I.—Total Cocaine Traffic, 1981.86
(exports to the United States based on production estimates)



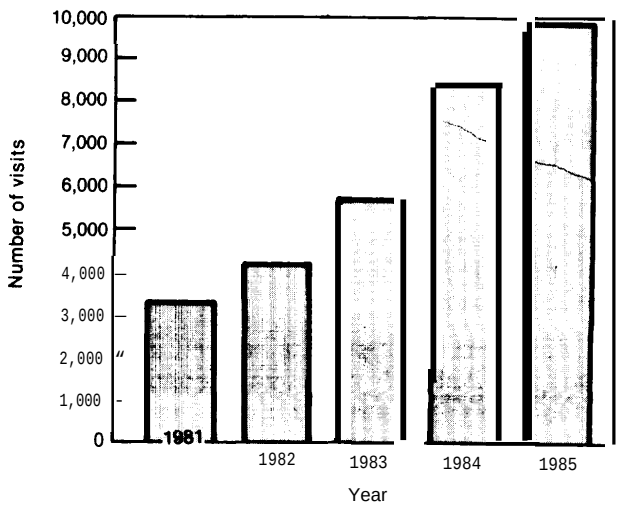
NOTE: Some law enforcement officials believe that this estimate is low and the actual cocaine imports have at least tripled in past 5 years

SOURCES: 1981-64: National Narcotics Intelligence Consumers Committee, *Narcotics Intelligence Estimate,* 1983 and 1984
1985: Drug Enforcement Administration, *Worldwide Drug Assessment,* June 1986.
1964-86: United States Customs, *Drug Smuggling Threat Estimate, 1984-86.*

Estimates are that the quantity of cocaine coming into the United States has more than doubled in the last 5 years (see figure 1). The number of cocaine-related hospital emergencies has been rising (figure 2) and cocaine use has spread to every part of the Nation. During the initial period of growth in cocaine use, it was marketed as a powder. The form in which cocaine is used, however, has been changing and at present a new form, ''crack, is spreading across the United States. Crack is particularly dangerous; compared with more common forms of cocaine, it is more potent, costs less per dose, and its effects last for a shorter time before the user craves more. By most accounts, it is highly addictive.

Data on cocaine production, traffic, and consumption from 1981-85 have been collected by OTA from several sources and are displayed in figure 3. These data illustrate not only major growth

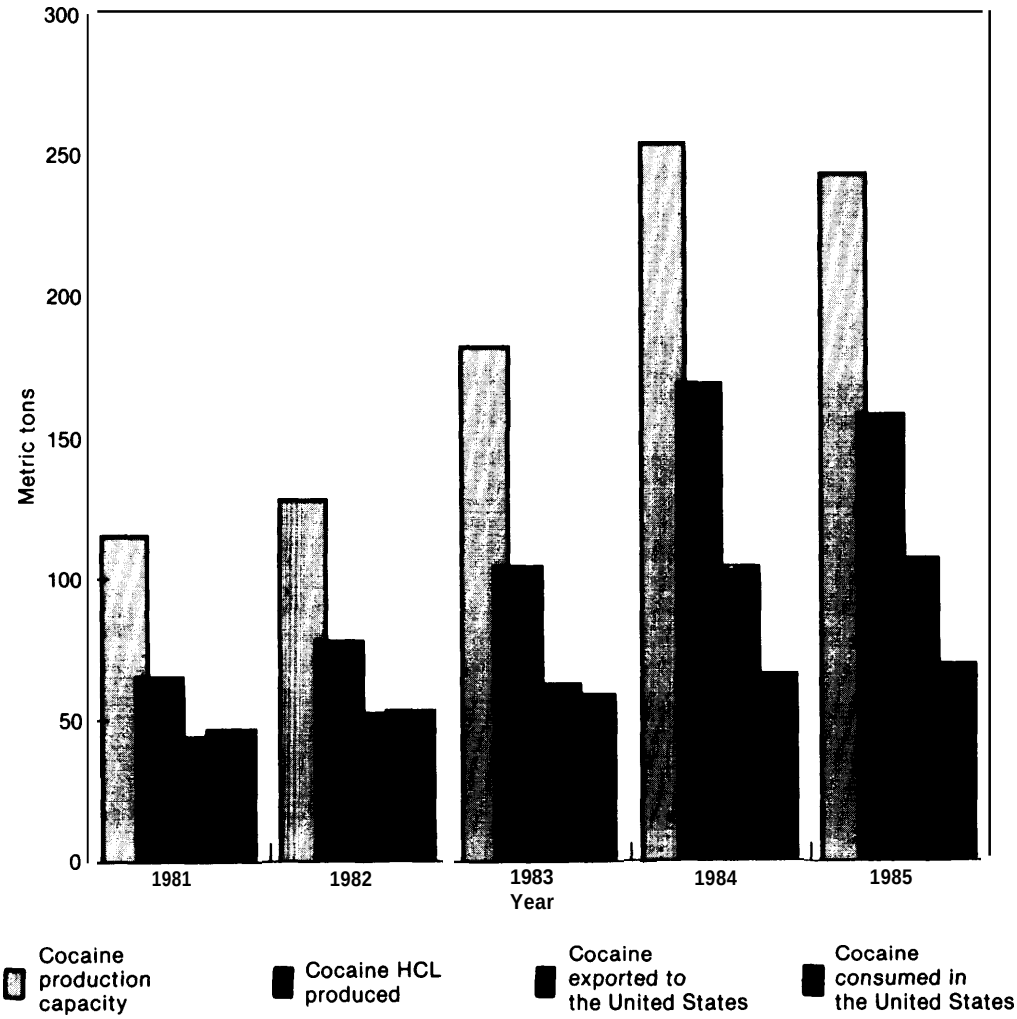
Figure 2.—Cocaine.Related Emergency Room Visits, 1981-85



NOTE: Only those emergency room visits reported through the DAWN system are included. Actual totals are probably higher.

SOURCE: Drug Abuse Warning Network.

Figure 3.-Cocaine Production, Traffic, and Consumption, 1981-85



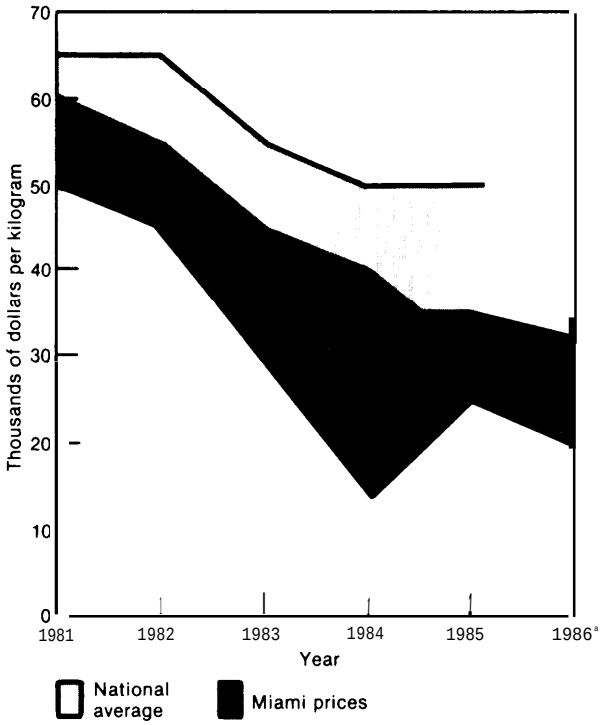
SOURCE: **National Narcotics Intelligence Consumers Committee, Narcotics Intelligence Estimate, 1983 and 1984; Drug Enforcement Administration,** *Worldwide Drug Assessment,* **June 1986.**

during this period but what appears to be a huge oversupply of this drug. Price data for the period, shown in figure 4, indicate a sharp decline which may contribute to the increasing numbers of users. Experts differ on the interpretation of these data and many claim they are too inaccurate to reach any conclusion.

Marijuana use appears to be declining in recent years, but it already represents a huge market, 18 million monthly users. Marijuana imports shown in figure 5 appear to have ranged between 10,000 and 12,000 metric tons for at least the past 5 years. Imports appear to be decreasing while domestic production is increasing, and larger quantities of imports are coming from countries closer to the U.S. border, mainly Mexico. In addition, assessments by U.S. drug agencies indicate that over the last decade the potency of marijuana being grown for the U.S. market has been steadily increasing.

Heroin use remains relatively stable and the user population has, at least until relatively recently, been concentrated in major metropolitan areas. Figure 6 shows heroin traffic (assumed equal to consumption) from 1981 to 1986 leveling off at about

Figure 4.—Cocaine Wholesale Prices in Miami and Nationwide, 1981-86



[a]First half of 1986

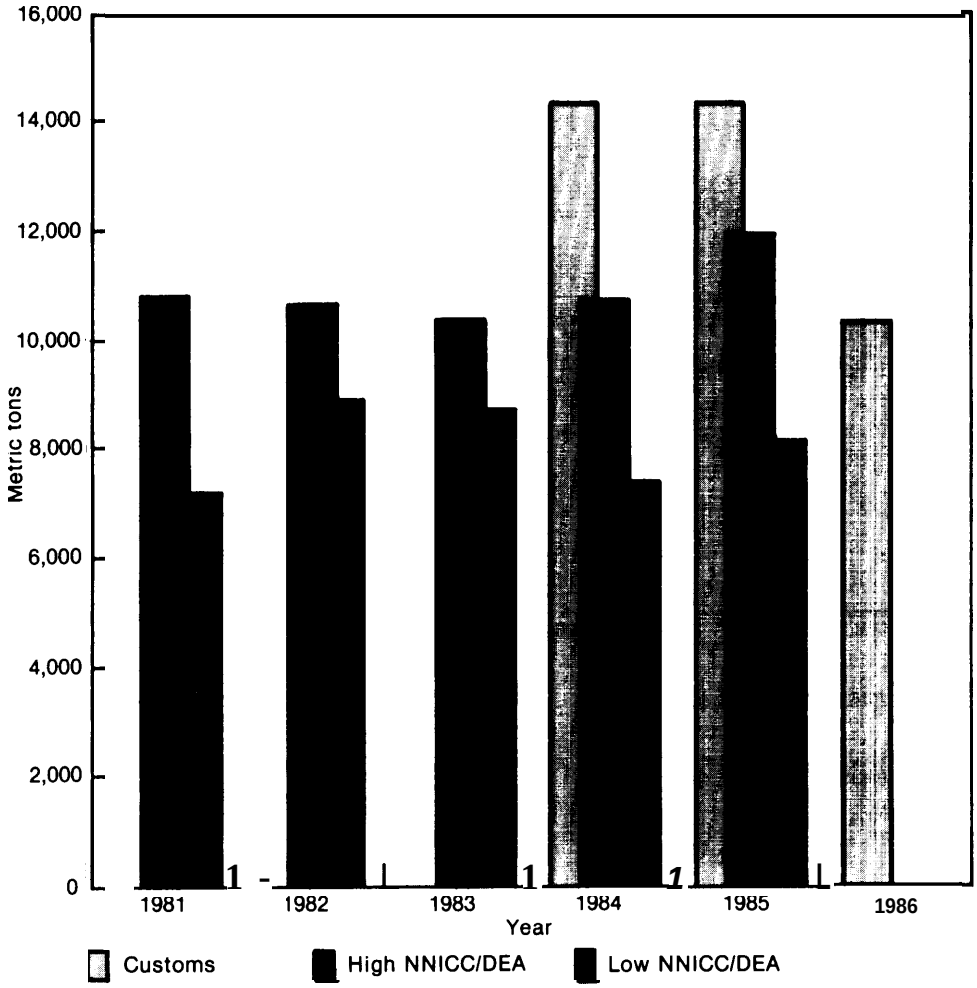
SOURCES: Art Nehrbass, Metro-Dade Police Department, personal communication, 1966 Drug Enforcement Administration, 1986.

6,000 kilograms for the past 3 to 4 years. A major change has been the recent rapid increase in the import of heroin from Mexico. One form of Mexican heroin, known as "black tar, is generally of both higher quality (i.e., higher purity) and lower price than heroin from other sources. Infusion of Mexican heroin has created a new problem for drug enforcement officials. The Drug Enforcement Administration preliminary data suggest a limited increase in heroin use during 1985.[6] This may be a function of the lower priced, high-quality Mexican heroin, plus the novelty of a new form.

In sum, overall trends suggest two developments. First, illegal importation of certain drugs into the United States is increasing. Second, the illegal drug industry is demonstrating a capacity to distribute more potent drugs in a variety of forms to suit the market. Cocaine is the drug causing the greatest public concern both because of its increasing availability and its dangers. During the early period of its growth in use, some portions of society saw it as a "safe' drug. Today few doubt the dangers of cocaine.

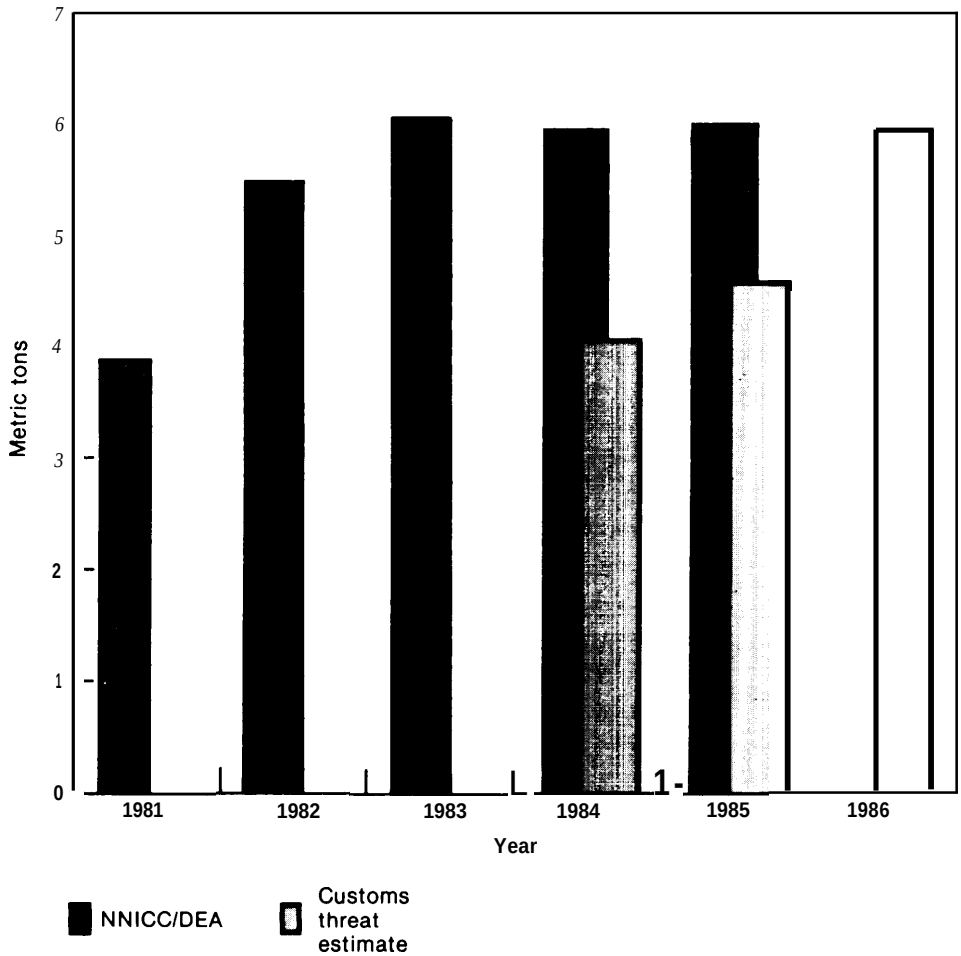
[6]Ibid., p. 3.

Figure 5.-Total Marijuana Traffic, 1981-86
(exports to the United States based on production estimates)



SOURCES: 1981-84: National Narcotics Intelligence Consumers Committee, *Narcotics Intelligence Estimate, 1983* and 1984.
1885: Drug Enforcement Administration, *Worldwide Drug Assessment,* June 1988.
1984-88: United States Customs, *Drug Smuggling Threat Estimate, 1984-88.*

Figure 6.—Total Heroin Traffic, 1981-86 (traffic assumed equal to consumption estimates)



SOURCES: 1961-64: National Narcotics Intelligence Consumers Committee, Narcotics Intelligence Estimate, 1963 and 1964.
1985: Drug Enforcement Administration, *Worldwide Drug Assessment,* June 1986.
1964-86: United States Customs, *Drug Smuggling Threat Estimate,* 1984-86.

THE WAR ON DRUGS

As the Nation has become increasingly aware of these problems and trends, efforts by the Federal Government to prevent drug abuse and trafficking have increased. Following the example of several predecessors, the President has declared war on drugs and has given the problem high visibility.

The national strategy for attacking the drug problem has five components: education, enforcement, treatment, research, and international cooperation. Efforts in each of these areas are expanding, but there is little evidence yet of success in the current war on drugs.

If the war on drugs is to be successful, the character of that war will need to be broadly understood. Perhaps the most important thing to recognize is that there will be no clean, clear victory. The enemy will not surrender, fold his tents, and return home. Understanding the challenge the Nation faces requires starting with the recognition that the drug problem is not new. Drug use has a long history in the United States. However, the relatively recent and large-scale use of cocaine seems to have triggered the latest declaration of war.

Thus, the war on drugs must be designed and executed with a recognition of the following factors:

- illegal drug use is woven into the fabric of the population,
- the population of drug users is large,
- there is literally a mass market, and
- the profits made from serving that market are very large.

The recent rapid growth in cocaine use has resulted in the development of a number of major new drug trafficking cartels with large financial resources and flexible and sophisticated delivery systems. When one adds these relatively recent cocaine cartels to the trafficking networks that supply the other drugs, the challenge faced is clearly formidable,

The networks that supply the Nation's drug users— the enemy in the war on drugs—is ill defined. While drug trafficking can be characterized as a system, it is a system made up of complex, decentralized, and infinitely flexible subsystems. Drug traffickers respond rapidly to pressure by using other strategies, routes, or delivery methods. Evidence suggests that even when major law enforcement operations disrupt or eliminate particular drug trafficking arrangements the benefits are only temporary. The vacuum that is left is quickly filled by other drug traffickers. And, finally, at every level from production through processing, transportation, and marketing the drug trafficking system can be changed to avoid detection.

The starting point for an effective war, and, more specifically, an effective interdiction program is to know what effectiveness means. Effective interdiction requires a tight linkage between national goals, organizational arrangements, and strategies. It seems evident that the Nation's goals involve stopping the growth of drug abuse. Doubtless, the public wishes to do more than that: specifically, to reduce the extent and frequency of drug abuse, The ideal would be to eliminate drug abuse in the United States.

None of the goal statements by high-level national policy groups provide clear direction for drug interdiction agencies on where to set priorities. Rather they allow each agency to define its goals as it deems appropriate. Redefinition can occur at will. In sum, such goal statements allow the individual agencies to define their individual goals to fit their capabilities and programs and not vice versa.

Certain drugs have been considered more threatening than others at certain times. Priorities for particular drugs were established in the past. Such priorities have followed changing drug popularity and changing perceptions of the magnitude of the drug problem. At present the Administration specifically refrains from setting priorities for specific drugs. However, it is generally agreed that limited resources require that some problems be given more attention than others. Interdiction programs have therefore been focused more on those drugs and modes of smuggling where they appear to have the most success (i. e., maritime smuggling of marijuana and private air smuggling of cocaine) and less on those drugs and modes where success is questionable (e. g., port of entry smuggling of heroin). The drug enforcement agencies argue that it is more effective to counter heroin trafficking by means other than interdiction, but that interdiction is effective against marijuana trafficking.

OTA's investigation suggests that a successful war on drugs will require clear goals and a long sustained effort (decades). Evidence of success will be difficult to obtain and interpret unless goals are fixed and long-range trends are measured.

THE DRUG TRAFFICKING SYSTEM

Interdiction seeks to prevent or disrupt the transport of drugs (chiefly marijuana, cocaine, and heroin) into the United States. The international illegal drug trafficking system has four components. The first consists of production and processing in foreign countries. The second involves the transportation system that moves the drugs from foreign source countries to and across the borders of the United States. The third component consists of the domestic distribution and marketing system. And the fourth and final component involves the recycling of drug monies out of the United States. Following is a description of each of these components as it relates to the three drugs of concern.

Production and Processing

Marijuana

Foreign countries provided about 10,000 metric tons (about 80 percent) of the marijuana consumed in the United States in 1985, with Colombia and Mexico each supplying about one-third. Jamaica and Belize supplies are substantially smaller, but they remain significant. The cannabis that is the source of marijuana can apparently be grown in almost any country, thus the proportion of marijuana coming from any specific country changes in any given year and is primarily a reflection of established production and marketing capabilities, weather conditions, local eradication programs, and interdiction efforts. Potential sources of supply appear to be nearly unlimited. Some believe Mexico will soon become the leading U.S. supplier. Domestic U.S. cultivation could supplant imports even more if it were lower cost and less risky. Some believe the trend to more domestic production is already occurring, although eradication and other control efforts are also underway.

Cocaine

Based on estimates of the number of hectares of coca cultivated, Peru ranks at the top of the list of coca producers with approximately 70,000 hectares (1 hectare = 2.47 acres). Bolivia is next with 30,000 to 38,000 hectares. Colombia is third with 15,000 to 17,000 hectares, with Brazil and Ecuador having small-scale cultivation. Colombia continues to dominate the final stage processing of cocaine and is the major export point to the United States. As government efforts to find and destroy processing facilities increased in Colombia and more recently in Bolivia, processing laboratories have been established elsewhere.

Heroin

Estimates are that the U.S. heroin market was supplied in 1985 as follows: Southwest Asia, 47 percent; Mexico, 39 percent; and Southeast Asia, 14 percent. A form of Mexican heroin, "black tar, appears to be taking a growing share of the U.S. market.

U.S. efforts to deal with the drug problem in the source countries involves a two-pronged approach. First, the United States has drug eradication agreements with 14 foreign countries, up from two in 1982. Under these programs the United States supplies funds and expertise to support source country efforts aimed at eradicating cannabis, coca, and opium poppies and processing facilities. Second, Drug Enforcement Administration agents support local efforts to identify and prosecute the individuals in source countries responsible for the drug traffic. The availability of other U.S. aid is sometimes linked to foreign cooperation in these efforts. The goal is to disrupt the organizational and management networks that feed the U.S. drug market.

Transport

The second component of the international drug trafficking system, transport to the United States, is the primary focus of this study. This system will be described in detail later. Transportation activities of concern are those which pick up drugs at the export point in a foreign country and deliver them to the domestic distribution marketing system in the United States. As will become clear in what follows, the transportation system is large, diverse, well-equipped, and flexible.

Domestic Distribution and Marketing

The third component of the trafficking system is the domestic distribution and marketing network. These activities are divided among distributors who receive drugs from the smugglers, wholesalers, and

retailers. OTA has not investigated this area and therefore cannot provide a confident description of the domestic distribution and marketing network. In some areas distribution and wholesaling is controlled by organized crime networks. In other areas there appear to be competing distributors and wholesalers. The link between smugglers, distributors, and wholesalers appears to be relatively well established, given the quantities of drugs being moved into the retail market. The network for marketing marijuana has expanded to a point where it is readily available in almost all areas of the United States. Similarly, the broad availability of cocaine suggests that its distribution and marketing system is beginning to parallel that of marijuana.

Efforts to prevent or disrupt domestic distribution and marketing are divided among Federal, State, and local authorities. Federal responsibilities are primarily directed at the smugglers and distributors. State and local responsibilities are primarily directed at the wholesalers and retailers. Domestic drug enforcement efforts include arrest and conviction of major drug distributors and wholesalers, seizure of drugs in domestic transport, arrest and conviction of drug retailers or pushers, and seizures of their assets. In addition, increasing efforts, primarily carried out at the local level, are focused on education programs aimed at existing and potential drug users with the goal of significantly reducing the market for drugs.

Recycling Revenues

The fourth and final component of the drug system involves the recycling of monies from the sale of drugs. The domestic drug wholesale and retail economy runs on cash, It is a multi-billion-dollar economy carried on with limited recourse to checks or credit cards, where the primary currency is $100 bills. Thus, the drug system must launder and transport huge amounts of currency, the ultimate need being to move large portions of those revenues out of the United States to support the production, processing, and transport of drugs and to return profits to the bosses of the trade.

Efforts to disrupt the cash flow of drug monies include financial reporting requirements for large banking transactions and U.S. Customs' efforts to detect outgoing currency at ports of entry.

Noninterdiction Options

Although this study did not investigate or seek to weigh the relative benefits of focusing drug law enforcement activities on the three nontransportation components of the system, any informed national policy must carefully weigh the costs and benefits of actions against these components vis-a-vis expenditures on activities aimed at the transportation component. More than 50 percent of Federal expenditures on drug law enforcement go to the interdiction activities, but it is by no means certain that this is the component of the system where the Nation gets the largest multiplier effect from given expenditures or given levels of effort.

On the other hand, some interdiction expenditures also benefit other elements. For example, a successful interdiction could yield evidence or other leads that save substantial investigation time. Also, some sensors provide both support for investigations and general data for international threat assessments and related options.

A few brief examples of noninterdiction options may be in order. Some have suggested that greater emphasis on reducing supply in producing countries would have a high pay-off. An example often cited to support control of supply is the successful program which essentially eliminated the illicit production of poppies in Turkey. Others, however, draw just the opposite conclusion. They agree that programs of eradication and control have been successful but the longer term result is usually to move production into other areas.

In addition, many, including DEA, contend that the investigation and prosecution of major traffickers and their organizations, and the seizure and forfeiture of their drug-related assets, have the most impact on disrupting drug traffic. DEA claims that their major investigations are usually the results of DEA or Task Force efforts—not a followup to a seizure at the border.

Many people interviewed in connection with this study believe that, given a high, continuing demand for drugs and the large profits associated with the illegal importation of drugs, the prospect of interdiction ever preventing or significantly limiting drug availability is doomed to frustration. Those who take this position often suggest that the highest payoff would come from education programs

or treatment programs that aim to reduce the demand for drugs. This point of view seems to be suggested by the current Administration campaign to ‘‘say no to drugs.

Finally, some of those interviewed suggest high payoff from focusing major attention on disrupting the recycling of revenues from drug sales. This point of view rests on the belief that tracking and seizing illegal drug profits cuts off the motivation for trafficking.

It should be noted that OTA found no one who argues that a single component of the drug system should receive all or even a majority of the attention to the exclusion of other components. Rather, the policy issue concerns the relative priorities, and therefore how resources should be allocated to various components. However, this allocation issue is beyond the scope of this study. The study focuses on strengths and weaknesses of interdiction efforts.

SMUGGLING ACTIVITIES

The fuel that drives the illegal importation of drugs into the United States is the huge increase in value between the foreign wholesale market and the domestic wholesale market. In the case of marijuana, the wholesale value in the United States is 20 to 30 times higher than it is in the source countries. OTA's calculations, based on 1985 data, suggest that transport of marijuana into the United States added roughly $6 billion to the value of the product. In the case of cocaine the domestic wholesale value is four to five times higher than the foreign wholesale value. Thus, transport added roughly $1.6 billion to the value of the cocaine, In the case of heroin, transportation added roughly $1 billion in 1985, increasing the value 30 to 40 times. Net profit margins of at least 90 percent of these added values attract participants who show great ingenuity in devising smuggling methods. Modes of transport range from commercial airplane passengers with drugs hidden in body cavities, to four-engine, long-range aircraft that start in South America and end in New England, to high-speed boats that are the envy of racing enthusiasts.

To understand the nature of the drug interdiction problem and the technologies available to support interdiction requires investigating three elements:

- the transport system and those who operate it;
- the organizational, jurisdictional, and geographic responsibilities of the Federal organizations that carry out interdiction activities; and
- existing and potential technologies and the strategies available to enforcement agencies.

Transport Modes

The starting point for any effort to gain a picture of the transportation system used by drug smugglers must be the recognition that the United States has a long and highly permeable border. The choice of transport mode for illegal drugs coming into the United States reflects three factors:

- the geographic location from which the drug is exported,
- the dollar value/volume ratio of the drug, and
- the smugglers perception of interdiction strategies and capabilities.

The maps in figures 7 through 9 provide a general picture of the routes whereby heroin, cocaine, and marijuana are illegally imported into the United States from Western Hemisphere source countries.

Heroin

The three sources of heroin destined for the U.S. market are Southwest Asia, Mexico, and Southeast Asia. Most of the opium poppies that supply the smuggling system from Southwest Asia are grown in Afghanistan, Iran, and Pakistan, with a small amount coming from India. Major export points for heroin produced from Southwest Asian opium poppies are Pakistan, Turkey, and India, with smaller amounts coming through Syria and Lebanon.

Mexican heroin is produced from poppies grown and processed in Mexico. It enters the United States across the 2,000-mile border with Mexico.

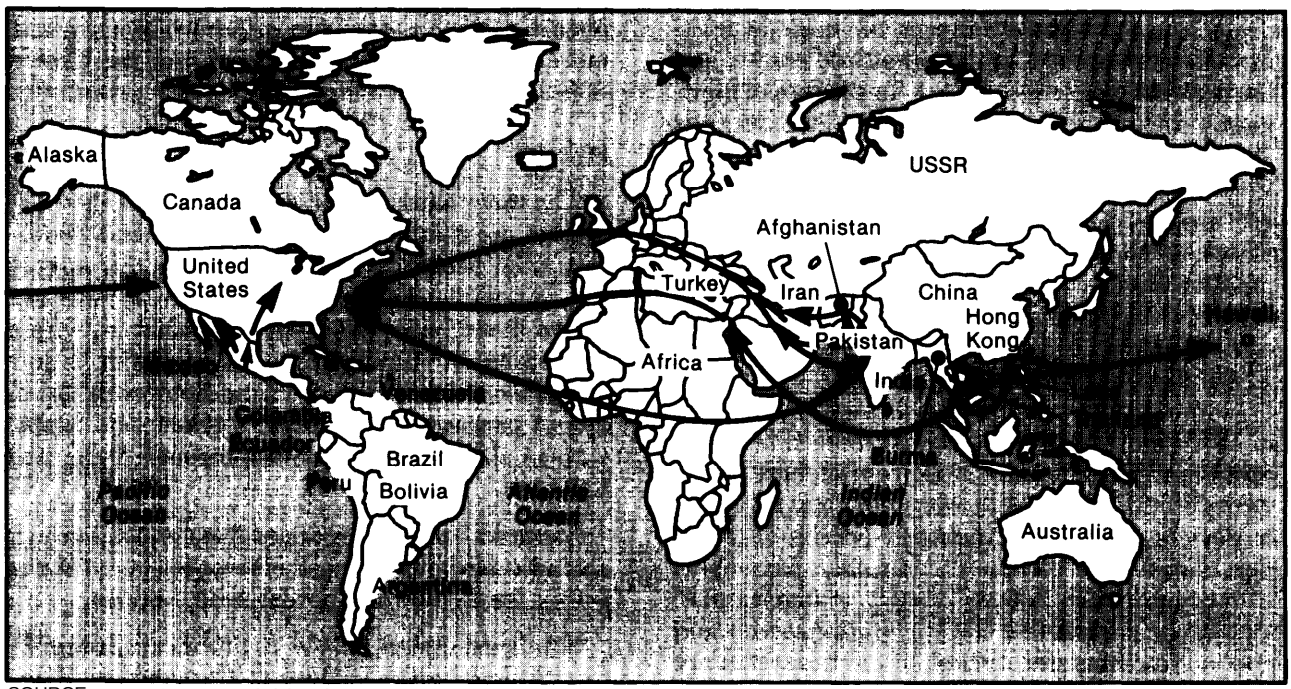
Southeast Asian heroin is produced primarily from poppies grown in Burma, Thailand, and Laos and generally processed along the Thailand-Burma border. It is then exported from Thailand and Malaysia.

Most Southwest Asian heroin is smuggled through European countries and enters the United States at ports of entry along the east coast. Southeast Asian heroin comes in primarily through Hawaii and west coast ports of entry. Usually Southwest and Southeast Asian heroin is transported via commercial aircraft in the possession of passengers who act as couriers. Smaller amounts are shipped in commercial vessels and through the mail. Air parcels appear to be more widely used for heroin exported from India than any other location. Mexican heroin is typically transported in vehicles or by persons. [1]

Because of its high value to volume ratio, heroin can be profitably imported into the United States in very small quantities. That fact, in combination with the long transportation distances, explains the use of commercial aircraft and vessels as the primary transportation mode. During 1985, 25 million passengers entered the United States on commercial airline flights, 48,000 ocean-going commercial

[1] Ibid., p. 24.

Figure 7.—Heroin Smuggling Routes From Source Areas to the United States



SOURCE: **Drug Enforcement Administration**

vessels entered U.S. sea ports from foreign ports, and 100 million letters and parcels entered through the postal system. Given this volume of traffic, the probabilities of interdicting smuggled heroin without prior intelligence (so-called ' 'cold hits' have some of the characteristics of finding the proverbial "needle in the haystack. "

Mexican heroin enters both at official ports of entry and between ports of entry. The number of persons entering from Mexico through official land ports of entry during 1985 was 115 million with as many as 3 to 4 million illegal entries between ports of entry. Although the form of transport is different, the Mexican border also poses a "needle in the haystack" problem.

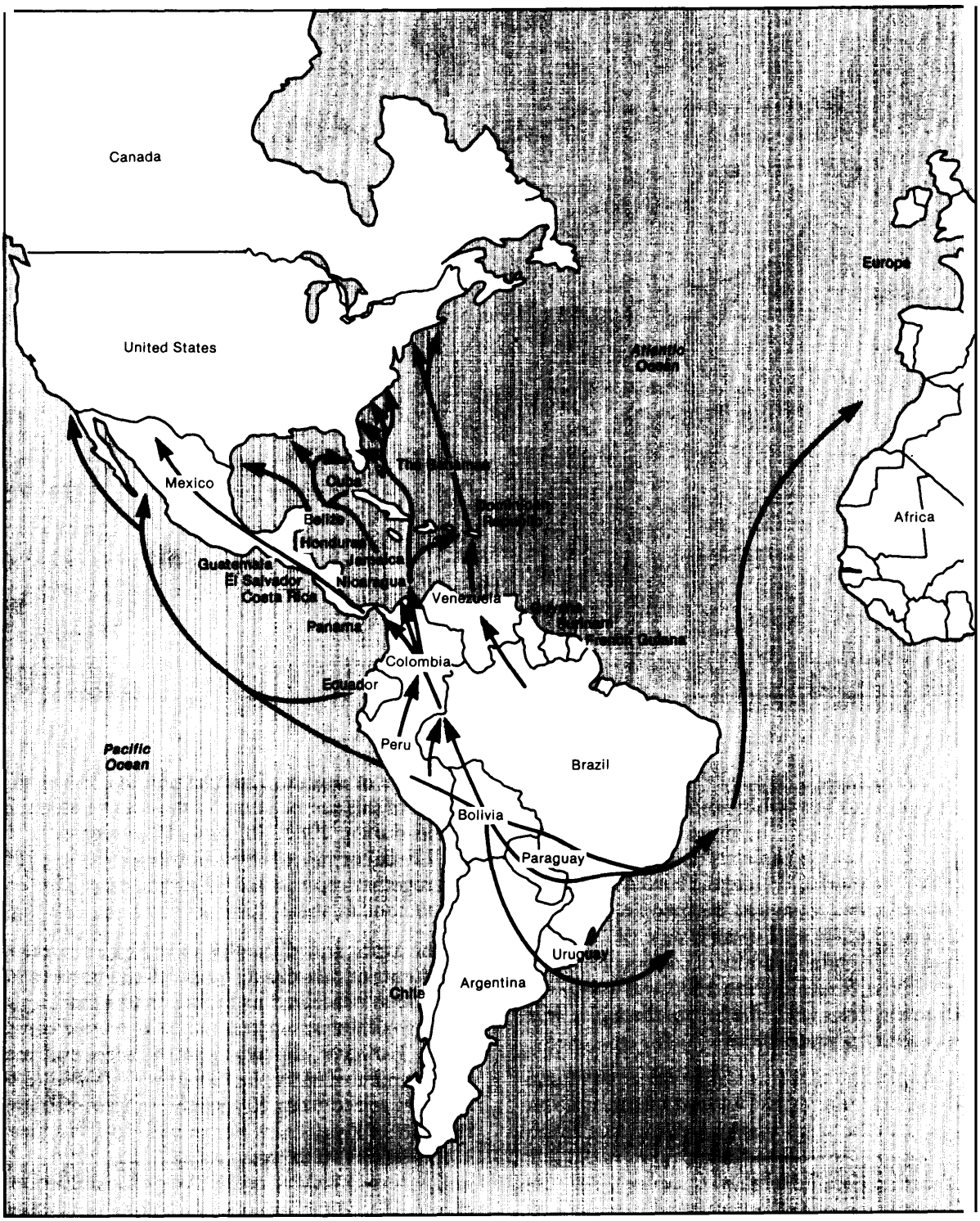
Cocaine

Colombia is the primary export point for cocaine. Cocaine enters the United States on all three coasts as well as across the Mexican border. Florida continues to be the largest import area, but entry through other Gulf Coast States is also large. Intelligence indicates that transshipment of cocaine via Mexico is increasing, probably as a result of interdiction efforts in Florida and the Caribbean.

Cocaine smuggling involves a complex, diverse, and flexible transportation system. Until recently, the majority of cocaine was thought to bypass the official entry process at ports. Seizure statistics indicated that, in 1985, private aircraft transported over one-half and private vessels one-quarter of cocaine imports. The remaining cocaine came by commercial aircraft, commercial vessels, and overland methods. However, recent large seizures and other intelligence indicate a growing use of ports of entry.

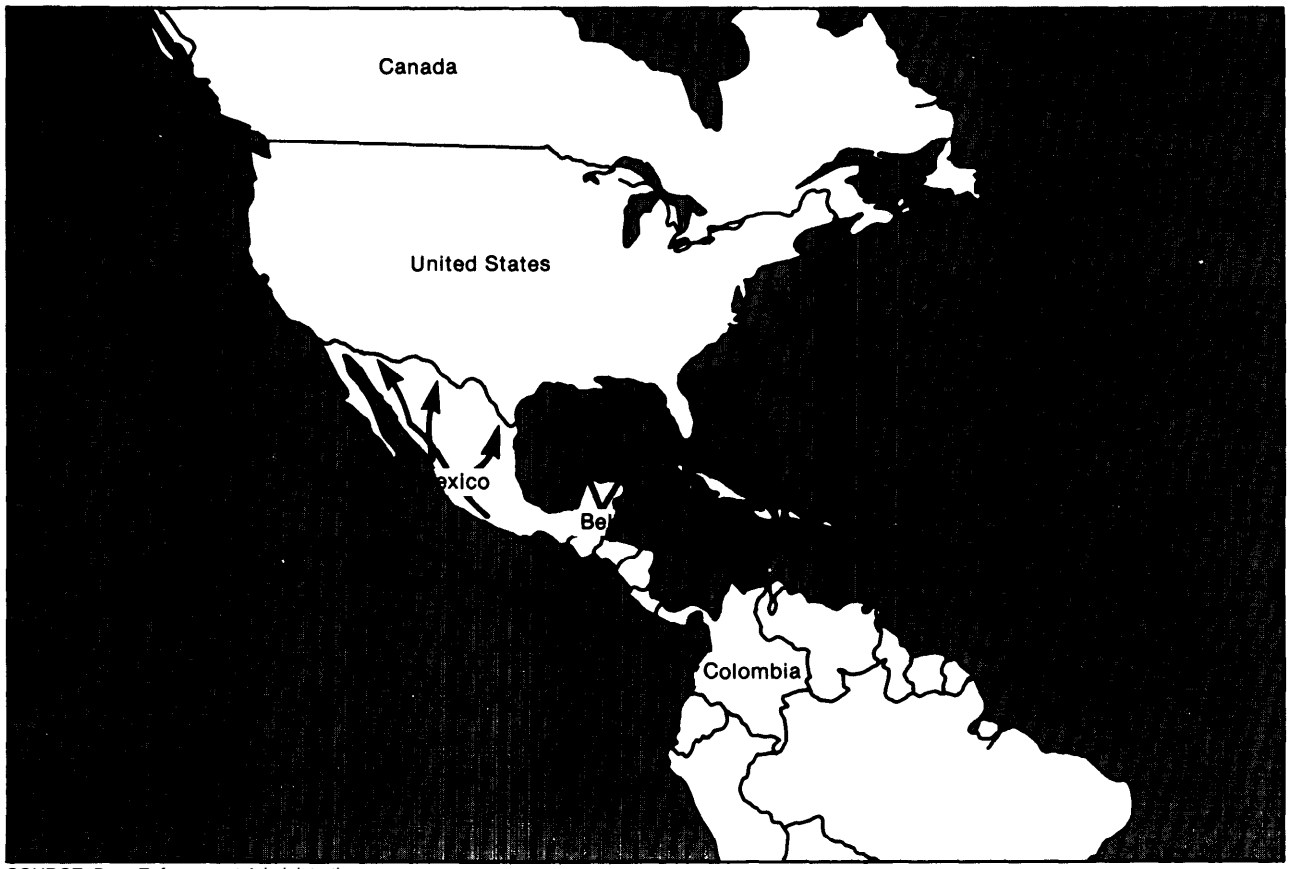
There is no one mode of transport clearly preferable for cocaine smuggling. The past preference of cocaine smugglers for noncommercial modes of transport is a reflection of several characteristics of the cocaine trade as compared to heroin. First, although cocaine sells on a weight basis for only one-fourth to one-half the price of heroin on the domestic wholesale market, it nonetheless has a high dollar value to volume ratio. Second, transportation distances for cocaine as compared to Asian heroin are short. General aviation aircraft can fly from Colombia to the United States without refueling and, depending on the departure point, private vessels can move to the United States in relatively short periods of time—a few days at most. In the case

Figure 8.—Cocaine Smuggling Routes From Latin America to the United States and Europe



SOURCE: Drug Enforcement Administration.

Figure 9.—Marijuana Smuggiing Routes From Latin America and the Caribbean to the United States



SOURCE: Drug Enforcement Administration.

of cocaine transshipped through the Bahamas, a go-fast boat can leave the Bahamas and be in Florida within an hour. A third factor which could influence the transportation choice of cocaine smugglers is the size of the market. While the heroin user population is estimated to be 500,000 people, the population of current cocaine users is at least 10 times that amount. The total quantity of cocaine imported into the United States during 1985 was probably over 100 metric tons while for heroin the figure was probably about 6 metric tons.

In combination, then, the dollar value to volume ratio of cocaine, the relatively short transportation distances, and the large market add up to a situation where there are substantial economies of scale in transporting cocaine by private aircraft and vessels. The average size of a cocaine shipment is in the range of several hundred pounds. Some illustration of this can be found in the cocaine shipments seized during 1985. In total, 121 seizures of 100 kg (220 lb) or more were interdicted during 1985, and together represented 41 metric tons. The average weight of these large seizures was 341 kg.

The risks and difficulty of trying to transport shipments of this size through official ports to date have been perceived as higher than other modes, leading cocaine smugglers to prefer private conveyances. However, the two largest seizures ever made were at ports of entry. In 1986, over 3,000 kg (6,900 lb) were seized from 40-foot shipping containers at the port of West Palm Beach and, in 1982, nearly 1,800 kg (3,940 lb) were seized from cargo at Miami International Airport. Available evidence indicates that when interdiction efforts put pressure

on particular locations or particular modes of transport the cocaine smugglers do not hesitate to switch to transport through ports of entry.

In sum, cocaine smugglers can and do make use of every conceivable means of transport. Thus, cocaine smuggling can only be stopped if every means of transport is restricted.

Marijuana

Imported marijuana comes primarily from Colombia, Mexico, Jamaica, and Belize, with smaller quantities originating in Brazil, Guatemala, Costa Rica, Panama, and Thailand. In addition, approximately 150 to 200 tons of the cannabis derivative, hashish, were smuggled into the United States during 1985. The principle hashish producing countries are Lebanon, Pakistan, and Afghanistan with small amounts coming from Morocco and India.

The vast majority of the Central and South American marijuana is transported to the United States in private vessels. The next largest mode of transport is private aircraft. Both marijuana and hashish coming from Thailand appear to use commercial vessels as the primary means of transport.

The mode of marijuana transport is a reflection of its low dollar/high volume character, the relatively short distances from export point to the United States, and the large volume marijuana market. These factors result in large individual shipments. The average shipment seized by American authorities in 1985 was 4 metric tons. Shipments of this size are difficult to bring through official ports of entry and too large for all except the largest aircraft. Thus, the primary pattern is to move marijuana into the United States along Gulf of Mexico and Caribbean sea routes bypassing official ports of entry. A particularly popular mode of transport has been so-called "mother ships." These ships transport large quantities of marijuana to points near the coast of the United States. The marijuana is then shuttled to shore on smaller boats. The other major means have been vessels which transport directly from export points to the border of the United States or through transshipment points in the Caribbean islands.

Mexican marijuana is predominantly transported across the border in land vehicles and private aircraft, although some is carried in by individuals.

Primarily because of the low dollar/high volume character of the marijuana trade, smugglers do not have as wide a range of transportion alternatives as those available to cocaine smugglers. Smuggling vessels sometimes carry both marijuana and cocaine.

An overview of the drug smuggling network indicates that U.S. borders are being assaulted from every direction and by every means of transport. Further, the smugglers have demonstrated a strikingly rapid response capability. When drug interdiction agencies focus attention on a particular mode of transport or a particular region, smugglers shift quickly to other modes of transport, other routes, or other strategies. They can, for example, simply wait out the period of interdiction pressure. Alternatively, they may send decoy vessels or aircraft with small amounts of drugs and, when authorities have focused attention on the decoys, dispatch larger shipments in follow-on vessels or planes.

Drug Trafficking Organizations

The people and organizations responsible for smuggling heroin, cocaine, and marijuana into the United States generally specialize in a particular drug. Traffickers range from individual entrepreneurs to tightly run, highly disciplined, well-financed organizations. At one extreme is the person who crosses into Mexico to purchase either



Photo credit: U.S. Customs Service

Border crossing stations such as this are increasingly used to smuggle illegal drugs from Mexico.

marijuana or heroin for personal use and/or for sale in a local market. At the other extreme are organizations that own or lease fleets of airplanes and ships for transporting marijuana or cocaine into the United States. The highest priority concerns of those responsible for drug law enforcement are, of course, the continuing criminal activities of major organizations that are involved in cultivation, production, smuggling, and distribution of drugs.

Although drug trafficking organizations have great variability, they commonly share several characteristics that allow them to succeed. The leaders of the organizations pay their members generously. They provide continuing support for members of the organization if they are arrested in the course of drug trafficking activities, and they provide support for the members' families. That same pattern of generosity extends to people who live in the areas where the organization is based or where its processing occurs. Thus, the drug traffickers are frequently viewed as local heroes. Any member of the organization who violates the code of secrecy, cheats, or informs on the organization faces the threat of death. In those instances where retribution cannot be taken directly on an informant or a violator of the organization, it is commonly carried out against family members. Some drug traffickers try to wreak their vengeance quickly and with no quarter given.

Another factor that contributes to the success of drug trafficking organizations is corruption in source, processing, and transit countries. In addition, drug law enforcement agencies lack the equipment, training, manpower, and funding to conduct effective anti-drug operations and investigations in source countries.

Figure 10 shows the major source countries and their relative gross revenues attributable to illegal drug trafficking.

Following are illustrative sketches of some of the types of organizations that traffic in heroin, cocaine, and marijuana. These sketches are general in character and are derived from public literature and interviews with drug enforcement officials.

Heroin

Southwest Asia is the largest source of heroin coming into the United States. A variety of organized crime groups are involved in that smuggling. Following is a general sketch of a Southwest Asian drug trafficking organization.

Southwest Asian organizations normally control the heroin system from the point where the poppies are harvested through the various processing steps to the delivery of heroin to an American wholesaler. Farmers who grow opium poppies are frequently linked to a specific organization. That is, the poppy crop is committed to a particular criminal organization from the time it is planted. Farmers commit their crops based on an agreement with the drug trafficking organization to pay a predetermined price.

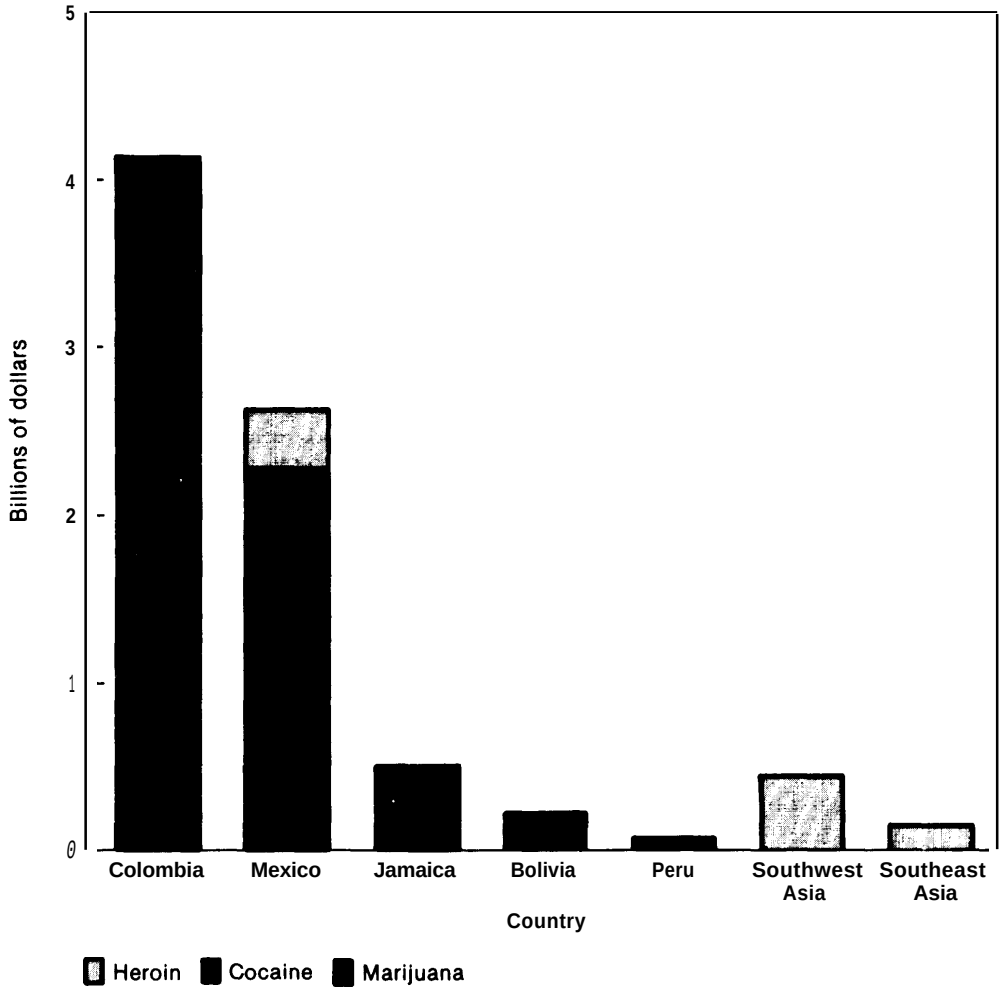
The organization converts the opium to heroin in its own crude laboratories. Transport to the United States is normally by individual courier traveling on commercial airlines via Europe. The head of the trafficking organization usually makes courier arrangements through representatives; however, in some instances he will make these arrangements himself. A typical shipment involves several couriers who take different routes but end up at a common U.S. location. The couriers may be professionals who regularly carry heroin, or individuals who make only one trip. The nonprofessionals are normally individuals who desire to enter the United States for personal reasons and are willing to act as couriers for the price of an airline ticket plus a predetermined fee.

Couriers normally deliver their heroin to a member of the drug trafficking family. Frequently the individual who receives the heroin in the United States is the same individual who has made the arrangements for the couriers in the exporting country. This individual normally does not carry heroin on his trip.

The recipient of the heroin then distributes it to other members of the drug family at geographically dispersed locations within the United States. These members of the family then sell the heroin to domestic wholesalers.

Southwest Asian drug organizations are sometimes the creations of and are managed by a single individual. They are highly personal organizations. The trafficking organizations are normally made up of individuals who are blood relatives, members of the extended family, and/or childhood friends

Figure 10.-Estimated Illegal Drug Gross Income to the Smuggler by Country or Region, Calendar Year 1985[a]



[a]The average of the difference between United States domestic and foreign wholesale prices was used to estimate these incomes

SOURCES: Office of Technology Assessment calculations based on data from: Average quantities smuggled: Drug Enforcement Administration, *Worldwide Drug Threat Assessment,* 1985. Prices: Drug Enforcement Administration, Intelligence Division,

of the head of the organization Thus, it is literally accurate to characterize these heroin criminal organizations as families. For this reason, it is extremely difficult for drug law enforcement agents or informers to infiltrate these organizations.

OTA did not investigate how the revenues from heroin are recycled to the country of origin or who transports the funds. It is generally believed that the majority of the monies are transported back in American currency.

Cocaine

The vast majority of the cocaine smuggled into the United States comes from Colombia and is under the control of some 10 to 12 cocaine cartels run and staffed by Colombians. The coca leaves from which the cocaine is made come primarily from two sources, Bolivia and Peru, where the highest quality coca leaves are produced in the Andes Mountains. Coca is grown as a cash crop and has been used for centuries by the indigenous population for

various purposes. Colombian cartels purchase the coca leaves from the farmers. In the late 1970s, the Colombian cartels initiated coca leaf cultivation in Colombia.

The coca leaves are processed into cocaine in laboratories controlled by the cartels. The cocaine is transported by various modes from those laboratories to the United States. A most frequent pattern is for the cartels to charter aircraft for purposes of transport to the United States. These aircraft may be rented by a pilot in the United States for a single round trip, or they may be chartered from individuals who own a fleet of airplanes and whose primary business is cocaine smuggling. The cartels sometimes use stolen aircraft, and on other occasions buy the airplanes that are used for smuggling.

However the cocaine is transported, it is normally delivered to members of the cartel located in the United States. Recent evidence suggests that the cartels are extending their control of wholesale cocaine distribution within this country. This extended supply system appears to include members of the cartel who are geographically dispersed throughout the United States. The Colombian crime organizations, then, appear to be more vertically integrated than is the case for those organizations which traffic in heroin and marijuana. Increasing vertical integration allows the cartels to enjoy the profits from a larger number of the steps in the supply system for cocaine.

The typical Colombian cocaine cartel is headed by an individual. A number of leaders of the cartels are well-known to the drug law enforcement community. The cocaine trafficking organizations are among the largest and most complex of the drug trafficking organized crime groups. Many of the cartels are believed to have financial resources that amount to several billion dollars. Although the Colombian criminal organizations include many members who are blood relatives of their leaders, their size appears to require the inclusion of members who are not literally family members. Where members are recruited outside the family they tend to be recruited from friendship groups. A common pattern is for cartel members to be people who have been life-long friends of the leaders, frequently people who have grown up in the same village or the same area as the leader.

Like the heroin organizations, the cocaine cartels maintain secrecy, loyalty, and discipline by using friendship bonds, financial rewards, and the threat of death for those who compromise the cartel. The latter point deserves special emphasis with regard to the Colombian drug organizations. Most drug law enforcement officials believe that the cocaine traffickers are the most violent of the drug traffickers. Cocaine-related killings tend to be particularly violent.

The cartels maintain communication systems which provide them with the ability to communicate with the aircraft and vessels used for smuggling. Finally, the Colombians use portions of their large cocaine-generated revenues to pay for protection and assistance in the source, processing, and transit countries and in certain areas of the United States where the cocaine is landed.

The cartels appear to be a dominant force in some portions of Colombia. Cartel leaders have used some of their revenues to provide health care and education facilities for people in the surrounding villages. There appears to be broad public support for the drug traffickers in some areas where they operate.

Many of those involved in drug law enforcement believe that the vast majority of the revenues generated by the sale of cocaine are cycled back to Colombia. A portion of these revenues are laundered through U.S. financial institutions. Recent evidence suggests that a growing portion of the revenues are being shipped out of the United States in $100 bills. This change is thought to be the result of two factors: 1) a growing focus by U.S. drug law enforcement authorities on recycling through financial institutions, and 2) the high rates of inflation in some South American countries have caused the drug traffickers to want to keep their revenues in relatively inflation-free U.S. currency. Some areas of South America are said to be operating on what is substantially a dollar economy.

Marijuana

A typical example of a marijuana trafficking organization is more difficult to sketch because of the diversity of sources of supply and the much larger number of marijuana traffickers. What fol-

lows is a sketch of typical organizations involved in the illegal importation of marijuana into the United States from Colombia.

The larger, better-organized marijuana trafficking organizations in Colombia purchase the marijuana from individual farmers and package the leaves into bales. Shipments to the United States normally involve several tons. The preferred form of transport is in coastal freighters or fishing vessels called mother ships. These vessels depart from the Colombian coast and make contact about 50 miles off the U.S. coast with smaller vessels that transport the marijuana to shore.

The larger, better-organized marijuana traffickers own or have under contract a number of mother ships. Marijuana trafficking organizations frequently use small aircraft for surveillance to determine where Coast Guard cutters are located and use communication systems to direct the mother ships along what are believed to be the safest routes. Criminal organizations that traffic in marijuana are essentially ocean transportation companies. They buy the marijuana in Colombia or other places and transport it to the United States where the marijuana is sold to domestic distribution and marketing organizations.

Like the criminal organizations involved in heroin and cocaine trafficking, those involved in smuggling marijuana tend to be creations of and managed by a single individual. They are generally composed of people who have either family or friendship bonds. The logistics of smuggling tons of marijuana require a large number of people to man the mother ships as well as the vessels that shuttle marijuana from the mother ships to shore. Marijuana organizations, nonetheless, appear to be just as tightly disciplined as those involved in heroin and cocaine smuggling.

It appears that in source countries those organizations handling marijuana and cocaine smuggling are separate and distinct. There have been a few instances where cocaine and marijuana have been transported on the same vessel, but this is the exception.



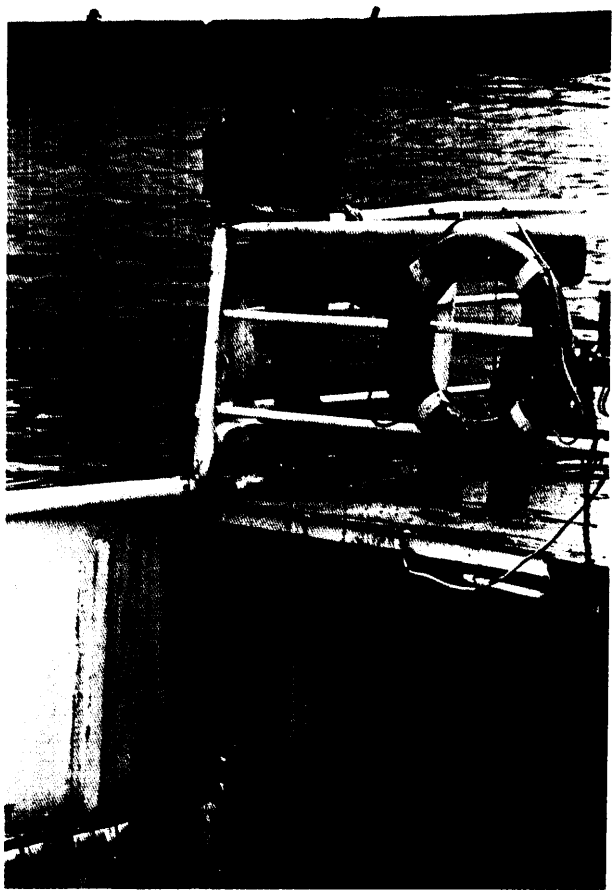




Photo credit: U.S. Customs Service

The criminal organizations involved in smuggling heroin, cocaine, and marijuana have demonstrated a capacity for responding flexibly to U.S. drug interdiction efforts. Although there have been many large drug busts by law enforcement officials, the criminal organizations involved in drug smuggling have demonstrated an ability to use other means to rapidly fill the supply gap resulting from major seizures. The large resources and highly disciplined character of the crime families and cartels suggest that the only way they are likely to be seriously disrupted is if the leaders and primary managers of these organizations can be arrested and incarcerated, and their assets seized and forfeited. Since many of the leaders are usually insulated from law enforcement and have their primary residences in the source countries, such arrests can only occur with the vigorous support of the governments of those countries.

ENFORCEMENT ORGANIZATIONS

An alphabet soup of Federal agencies is involved in carrying out the Nation's efforts to combat contraband drugs. The agencies with direct drug enforcement and/or interdiction responsibilities are: the Drug Enforcement Administration, the Federal Bureau of Investigation, the Customs Service, the Coast Guard, and the Immigration and Naturalization Service (Border Patrol). In addition, a wide variety of other agencies support the interdiction efforts. And other organizations have been set up to coordinate activities, including large-scale, multi-agency special operations.

Most of the organizations have multiple responsibilities, frequently responsibilities that are of equal or higher priority than drug interdiction. Drug interdiction activities include the routine efforts that are worked into the normal operations of the agencies and special intensive multi-agency operations.

The complex of organizations responsible for drug interdiction is characterized by fragmentation, and there are many impediments to effective cooperation. This fragmentation makes information exchange, coordination, and cooperation difficult. Many of these problems are resolved at least temporarily, during large-scale, intensive, special interdiction operations.

What follows is a brief characterization of the capabilities and responsibilities of the organizations that carry out and support the Nation's efforts to block drug smuggling. Routine operations are described for the agencies. Special multi-agency operations are described with the coordination organizations.

Drug Enforcement Administration

The Drug Enforcement Administration (DEA) was established in 1973 as the lead agency in the Federal Government's efforts to suppress the illegal drug trade. A division of the Department of Justice, DEA is the only Federal agency that has drug violations as its sole responsibility. DEA has primary responsibility for investigating drug-related events and operations; for collecting and disseminating drug-related intelligence information; and for securing cooperation and coordination between those Federal, State, and local agencies which have responsibilities and capabilities for conducting drug interdiction operations and other drug-related activities. DEA's responsibility directly related to border interdiction is mainly gathering, analyzing, and providing intelligence, and investigating the violators when drug smugglers are caught.

DEA's mission is both domestic and foreign with a total of over 2,400 special agents and intelligence analysts located throughout the United States and in 42 countries worldwide. These agents and analysts provide intelligence not only on the general character of international drug trafficking systems but also on specific smuggling activities. This intelligence collection begins in the source countries and includes information and analysis on drug production and processing laboratories. DEA is able to provide information from source countries on smuggling routes; and, by tracking and analyzing that intelligence over a period of time, is then able to draw conclusions regarding trafficking trends and organizations involved in smuggling.

Intelligence collected by DEA agents is a major source of information alerting the agencies with direct operational responsibility for interdiction of drugs in transport. DEA, through the El Paso Intelligence Center (EPIC), also collects, analyzes, and disseminates tactical drug intelligence from all enforcement agencies.

The dominant philosophy of the Drug Enforcement Administration is to eliminate drugs as close as possible to their source and to disrupt the drug trafficking system by collecting evidence on traffickers leading to arrests and convictions. Investigations resulting from interdiction provide useful evidence. DEA, in seeking to identify drug trafficking networks and key individuals in those networks, sometimes prefers to allow drug shipments to enter the United States so that it can follow their movement and obtain the necessary evidence to convict leaders of the organizations. The DEA focus on convictions as opposed to immediate interdiction is sometimes in conflict with the strategy of other agencies whose goal is to interdict drugs. Mechanisms are available, however, for DEA to notify Customs or Coast Guard when it does not want a drug shipment seized at the border and for Customs' inspectors at ports to contact DEA when drugs are detected to determine whether or not to seize them immediately.

Federal Bureau of Investigation

The Federal Bureau of Investigation, as the chief law enforcement arm of the Federal Government, exercises jurisdiction over violations of all U.S. laws. In 1982, the FBI was designated by the Attorney General to exercise concurrent jurisdiction with DEA for the overall drug law enforcement effort.

The FBI currently has 1,000 special agents assigned to drug cases. The primary focus of the FBI's drug investigative activity centers on organized crime families trafficking in drugs and illegal financial transactions. If, in the course of pursuing one of the above, the FBI receives information of transborder smuggling that might lead to a seizure of drugs or arrest of a smuggler, it passes that information to DEA, or the appropriate interdiction agency.

Both the FBI and DEA are responsible for enforcing the Controlled Substances Act. However, the FBI has stated it is usually more concerned with drug-related violations of such laws as the Continuing Criminal Enterprise (CCE) statute and the Racketeer Influenced and Corrupt Organizations (RICO) law.

The FBI brings considerable experience and expertise to the drug law enforcement effort and attempts to define its role as complementary to DEA's. However, some degree of conflict, overlapping responsibilities, and confusion about jurisdiction between the FBI and DEA was noted by OTA's advisory panel as detrimental to aspects of drug law enforcement.

Coast Guard

The Coast Guard focuses on identification and interdiction of maritime drug smuggling, principally by private, sea-going vessels. The Coast Guard focuses major drug law enforcement efforts on the open ocean, although it also conducts patrols and makes seizures in near-shore areas where it has concurrent jurisdiction with the U.S. Customs Service. The major portion of the Coast Guard's drug law enforcement efforts is concentrated in the Gulf of Mexico, the Caribbean, and around south Florida.



Photo *credit U.S. Coast Guard*

The Coast Guard boards and searches suspect vessels on the high seas as part of their drug interdiction mission.

Coast Guard seizures are of three distinct types. First, seizures that occur incidentally in the course of carrying out other missions. Most incidental seizures occur in connection with search-and-rescue operations where the vessel in trouble turns out to be involved in smuggling. Second, seizures resulting from hard intelligence that provides the approximate position and time of the smuggling operation. These operations are usually high-payoff. Because of this characteristic, the Coast Guard is now developing its own intelligence capabilities. The third and predominant type of seizure results from drug interdiction patrol operations. Coast Guard cutters, frequently supported by aircraft, search for, identify, visually inspect, and board suspicious targets.

Coast Guard routine drug patrol operations concentrate on four Caribbean and Gulf of Mexico choke points (shown in figure 8). The primary foci of these patrols are mother ships that meet contact boats near the coast that deliver the drugs into the United States. The Coast Guard has established profiles of the vessels commonly used as mother ships.

The vast majority of Coast Guard seizures are of marijuana, although the quantity of cocaine seized in 1984 and 1985 increased markedly. Available data indicate that the Coast Guard interdicts 10 to 15 percent of marijuana transported by sea. Most seizures result from dedicated drug patrols.

The constraints on the Coast Guard's ability to interdict drug smuggling are several. First, although the Coast Guard focus is on choke points, these may be expanses of ocean 100 miles wide patrolled by a single cutter. Thus, surveillance, identification, and capture is difficult. Second, the quantity of vessel traffic through choke points is large, and only a small number of the vessels can be stopped and searched. Third, the Coast Guard is currently able to maintain choke point coverage only part of the time. Several factors explain this. The Coast Guard has limited equipment and personnel resources. When a drug seizure occurs, the cutter must escort the seized vessel to a U.S. port, and this escort often ties up the cutter for several days leaving the choke point unpatrolled. Finally, even when Coast Guard vessels are committed to dedicated drug patrols, their highest priority is search and rescue. Faced with a choice between seizing a vessel and search and rescue, the Coast Guard will carry out the search-and-rescue operation.

The Coast Guard states that its drug interdiction goal is to ' 'eliminate the maritime routes as a significant trafficking mode for the supply of drugs to the U.S."8 Its operational strategy is directed at apprehension of smugglers, vessels, and the drugs. Existing resources and capabilities suggest that success in achieving the goal of eliminating maritime routes is not a near-term prospect.

Customs Service

The Customs Service has primary interdiction responsibilities for drugs smuggled through official ports of entry and by general aviation, as well as concurrent jurisdiction with the Coast Guard vessels in coastal waters of the United States, up to 12 miles off shore, the ' 'Customs zone. Responsibilities for these three areas are assigned to separate units within the Customs Service.

As of late 1986, the Customs Service had about 4,200 full-time inspectors (with about 500 assigned to special contraband enforcement teams) located at 290 ports of entry. They have responsibility for processing all individuals entering the United States. The total number of such persons is almost *290* million annually. Customs inspectors also have responsibility for processing all international cargo, all vessels entering sea ports from foreign countries, all aircraft entering the United States from foreign countries (including general aviation aircraft), all land vehicles (trucks, buses, trains, and cars) entering from both Mexico and Canada, plus all international mail. In addition to drug interdiction, Customs officers have responsibility for regulations and laws related to immigration, agriculture, health, trade restrictions, and, of course, collection of duties. Some of these responsibilities are shared with other agencies. Customs indicates that it assists in the enforcement of some 400 provisions of law on behalf of 40 government agencies. The Immigration and Naturalization Service helps perform some drug enforcement activities at ports-of-entry.

Customs also has responsibility for assisting the Commerce Department in protecting against illegal exports of high-technology products. Finally, Customs inspectors are expected to facilitate movement of traffic through ports of entry. Under the present administration, Customs inspectors are directed to give priority attention to law enforcement, specifically drugs.

The Agency's interdiction strategy at ports of entry has several components. First, it operates most effectively when it has good prior intelligence. Such intelligence comes from paid informants, private citizens, transporation companies, and intelligence agencies. Customs has increased its efforts to gain the cooperation of major carriers and facility managers. Second, inspectors select individuals, cargo, and vehicles for detailed inspection on the basis of profiles. Profiles may include such data as the origin of the individual or cargo; the sex, age, or citizenship of the individual; or any of a variety of other characteristics associated with individuals, luggage, cargo, or vehicles. Third, inspectors carry out periodic, random checks of passengers and cargo which may involve intensive blitz operations. Finally, Customs uses dogs to sniff out hidden drugs, metal probes, and a variety of support and detection technologies.

Using the above strategy, Customs processed the following traffic through official ports of entry during 1985: 506,000 aircraft, 89 million land vehicles, 204,000 sea-going vessels, 100 million parcels and letters, and 253 million persons who crossed

'U.S. Coast Guard, ' 'U.S. Coast Guard Drug Interdiction Mission, " Operational Law Enforcement Division Report, Washington, DC, January 1986.

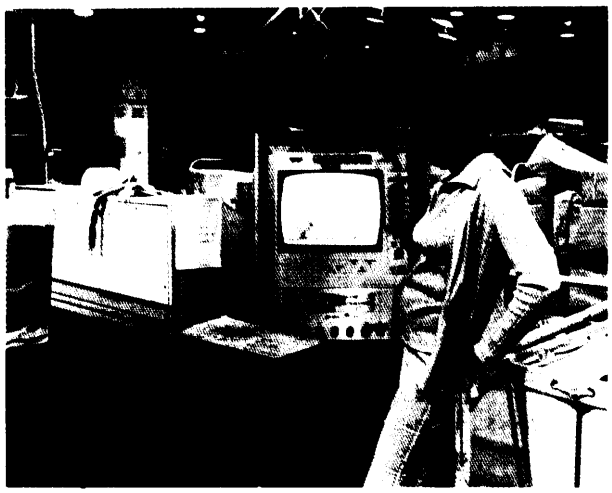


Photo credit: U.S. Customs Service

The Customs Service inspects international mail parcels from selected regions using X-ray technology.

the Canadian-American and Mexican-American borders.

The amount of illegal drugs coming through ports of entry is believed to be much higher than the amount that is seized. Clearly, Customs has a formidable task, given the quantity and diversity of people and items processed through ports of entry.

Customs responsibilities for interdicting drugs in the Nation's near-shore waters rest with its Marine Branch. In 1986 it had 472 personnel and 155 operational vessels distributed among 54 Marine stations. About 80 percent of the fleet is located in regions that cover Customs waters from Virginia to Texas. Florida has the largest concentration of Customs' Marine capabilities. Customs units typically go to sea for the purpose of stopping and searching in-coming vessels that have been identified by intelligence or are behaving suspiciously. Small, high-speed vessels (called "go-fast boats") illustrate one type of suspect vessel.

Effective near-shore interdiction frequently requires a quick response since the focus is on small and often fast smuggling vessels used to make the transit from the Bahamas or from mother ships.

Normally, Customs interceptor craft are directed to targets by land-based radar or radar located on other boats that are part of the interceptor team. Interceptors are usually unmarked and chosen to blend into the mix of boats operating in their area.

The best-developed Customs marine interdiction capabilities appear to be in the Miami area, where the Blue Lightning Operations Center (BLOC), was established in February 1986. BLOC will collect and coordinate radar information from air-, land-, and marine-based radars. It is intended to be a joint Customs and Coast Guard marine command and control center. It can track certain suspicious vessels, display information on video screens, plot the course and speed of suspect targets and direct interceptors to them. BLOC also is developing the capability for communicating with operational units of local law enforcement agencies. Finally, the center maintains tactical intelligence files and coordinates with other enforcement agencies in the Miami area.

The Customs' Marine Branch faces a formidable challenge since it is responsible for the entire U.S. coast line that smugglers assault using a wide array of techniques. Drugs may be hidden in containers, carried by crew members of vessels, swum in from ships anchored close to shore, or air-dropped with attached beacons relatively close to shore for immediate or delayed pickup by small boats which leave from and return to the U.S. coast. Given the heavy concentration of craft in urban coastal areas, Customs' Marine Branch faces a difficult problem in determining where the threat will justify deployment of its limited resources. Since it has joint authority with the Coast Guard in these waters, the agencies also face a major challenge of cooperative planning, setting strategies, and jointly allocating resources.

The Customs Air Branch is responsible for interdicting airborne drug smuggling. In 1985 general aviation aircraft were estimated to be the mode of transport for over 50 percent of cocaine and 4 percent of marijuana entering the United States.

In April 1986, the Air Branch had 234 personnel and 100 aircraft, 23 specially equipped for air interdiction, the others being used in various support roles. An OTA analysis, using 1984 data, estimated that between 1,300 and 3,500 drug smuggling flights enter the United States each year, an average of 3.5 to 10 flights a day. Drug smugglers prefer light, twin-engine general aviation aircraft

and normally fly at low altitudes which puts them under the line-of-sight coverage of coastal radar. Smugglers typically operate at night to minimize the chances of visual sighting.

Air interdiction begins with aircraft identification and sorting. Identification may come from prior intelligence or from radar coverage. The Air Branch relies on surveillance by Federal Aviation Administration (FAA) radar as well as its own.

Once suspicious aircraft have been identified, they are normally tracked both by radar and/or by chase planes. Interdiction normally involves the Customs Service utilizing strike teams carried to the landing site by helicopters.

Carrying out an air interdiction operation is a complex communications and coordination activity. Following a plane from Colombia to a landing site in, for example, Tennessee may involve not only a team of aircraft and helicopters but coordination with FAA, the North American Air Defense Command (NORAD), and a variety of Federal, State, and local police organizations. The problem is made more difficult because the drug smugglers may not have the drugs on board when they land the airplane. In some instances smugglers fly in, air drop, or land their cargo at prearranged sites and then fly on to landing sites elsewhere in the United States. Interdicting drugs under these circumstances is particularly difficult.

Border Patrol

Minimal effort has been devoted to interdicting drugs that bypass ports of entry on the Mexican border. Until the early 1980s, the Customs Service had some presence along this border, but most of those resources have been moved to other areas. The Federal agency most actively involved in interdiction on land between ports-of-entry is the Border Patrol (under the Immigration and Naturalization Service, Department of Justice). While the Border Patrol has no specific statutory authority for interdicting drug shipments, it intercepts drugs and smugglers in the course of performing its primary function—enforcing laws related to the admission, exclusion, and expulsion of aliens. All Border Patrol officers along the Mexican border have been given more formal authority to perform drug interdiction and related law enforcement tasks by designation from DEA. Cross designation of 1,000 Border Patrol officers by Customs was recently announced as part of a stepped-up Southwest Border initiative known as "Operation Alliance, " and some Border Patrol agents are being trained by DEA, enhancing their ability to conduct drug searches and arrest violators in the course of their normal duties.

At the close of 1986 the Border Patrol had approximately 3,700 officers, with 3,000 located along the 2,000-mile U.S./Mexican border. Most of the drugs coming into the United States from Mexico are thought to pass through ports of entry. There is growing evidence, however, of an increasing volume of drugs crossing the border between ports of entry. As interdiction efforts in other areas increase in effectiveness, the U.S.-Mexican border offers an attractive alternative. Historically, Mexican marijuana has been the primary drug smuggled across the border. Transport modes include groups of people carrying marijuana in backpacks, cars, trucks, horses, and rafts. Some drug smugglers enter the United States through the same routes used by illegal aliens, and some of the people who smuggle aliens also smuggle drugs.

The challenge faced on the Mexican border is clear when it is recognized that the Border Patrol made almost 1.8 million illegal immigrant apprehensions in fiscal year 1986. The Border Patrol believes that an even greater number—in part made up of persons previously apprehended and released —successfully entered the United States without being captured. Law enforcement coverage of the border is so sparse that it is doubtful whether a clear picture of this drug smuggling mode exists.

Support Agencies

Several Federal agencies cooperate with and support the Coast Guard and Customs Service in carrying out drug interdiction. Support and participation ranges from intelligence to equipment and/or personnel to participation in special concentrated interdiction operations. The Department of Defense and the Federal Aviation Administration and State and local enforcement agencies are discussed here. Other support agencies include the Department of State; the Intelligence agencies; the Internal Revenue Service; the Bureau of Alcohol, Tobacco and Firearms; and the U.S. Marshals Service.

State and local law enforcement agencies also cooperate with and support Federal interdiction activities on a case-by-case basis. In many areas, special task forces exist to facilitate coordinated drug enforcement operations among Federal, State, and local organizations.

Department of Defense

The largest scale support for Coast Guard and Customs Service interdiction is provided by the Department of Defense (DOD). DOD support has been growing since 1981 and, under several new initiatives, it is likely to continue to expand.

The historical separation of police and military authority is defined by the Posse Comitatus Act. It was revised in 1981 amendments to relax the proscriptions against using military equipment and personnel for civil law enforcement. While the DOD personnel still may not make arrests, their support role was redefined to include sharing of intelligence, providing facilities and equipment, and assisting in certain operations leading to arrest and seizure.

DOD now plays an important role in drug interdiction. DOD loans various types of aircraft and other equipment to the law enforcement agencies. DOD aircraft fly regular surveillance missions to detect potential smugglers, and Navy ships frequently carry Coast Guard Tactical Law Enforcement Teams (TACLETS) to board suspect vessels. Resources from all the military services support various special interdiction operations. An April 1986 National Security Decision Directive (NSDD) on Narcotics and National Security, coupled with anticipated additional resources to be provided by the military for air detection, reemphasize the DOD support role in interdiction and drug law enforcement. The NSDD calls for an expanded role for U.S. Military Forces in supporting counter-narcotics efforts. The Anti-Drug Abuse Act of 1986 authorizes DOD to procure and loan additional equipment to law enforcement agencies and to transfer funds to the Department of Transportation to be used for the Coast Guard's TACLET program.

While the Anti-Drug Abuse Act of 1986 calls for DOD to loan or transfer to drug enforcement agencies a number of specific additional technologies (airplanes, radars, aerostats, communication equipment), expectations also are for increased use of DOD surveillance systems in identifying and tracking drug smugglers. Possibilities could range from land-based detection systems operated by NORAD, to detection systems carried by Air Force, Army, and Navy aircraft, to the shipborne detection systems operated by the Navy. DOD is also required to provide a list of options and a plan to assist drug interdiction agencies for congressional approval during 1987.

Many observers believe that another of the assets DOD could bring to drug enforcement operations is its extensive command and control capabilities. Other areas, which have not received much attention, include DOD assistance in systems design as well as R&D including sharing of capabilities in national laboratories. The personnel and equipment resources of the Department of Defense offer the possibility of significantly increasing the pressure on drug traffickers.

Federal Aviation Administration

The Federal Aviation Administration supports drug interdiction with its radar and flight information systems. Recently, FAA has required all flights by private aircraft originating in other countries to file flight plans 24 hours in advance and to land at the airport nearest to its point of entry that has a Customs officer. By coordinating flight plan information with radar surveillance, any aircraft crossing a U.S. border without a flight plan can be identified as suspicious. A major problem is that significant areas of the U.S. southern border do not have low-altitude coverage by FAA radar, so small craft flying at low altitudes frequently go undetected.

State and Local Enforcement Agencies

State and local law enforcement agencies are regularly involved in drug interdiction activities on a case-by-case basis. Frequently, the State and local organizations provide a substantial portion of the manpower involved in drug arrests, and cooperation between these agencies and the Federal enforcement agencies is important to effective drug interdiction activities. In numerous instances there are enforcement groups made up of Federal, State,

and local officials that operate on a continuing basis. For example, at the airport in Honolulu, a continuing enforcement group involves Federal agents and members of the Honolulu Police Department.

Coordination Organizations

Effective drug interdiction requires cooperation and coordination among a large number of agencies. Consequently, a number of coordinating mechanisms have emerged. The National Drug Enforcement Policy Board, under the chairmanship of the Attorney General, seeks to provide unified direction and to develop and coordinate overall national policy.

The National Narcotics Border Interdiction System (NNBIS) was created to provide guidance for interdiction operations. Under the chairmanship of the Vice President, NNBIS seeks to coordinate the activities of the national enforcement agencies and to facilitate other agency assistance—especially from DOD and the intelligence community. Regional NNBIS units have been created at six locations, These regional components of NNBIS are chaired by the heads of various regional enforcement organizations that have primary responsibility in a particular area. For example, three of the regional NNBIS units are chaired by Coast Guard admirals. The regional NNBIS organizations have been particularly important in coordinating operations among Federal drug enforcement, Department of Defense, and local law enforcement agencies.

To supplement routine interdiction activities, NNBIS has coordinated major special operations involving both national and international drug law enforcement activities in recent years. Some of these operations are designed to disrupt the flow of drugs through particular geographic areas. Others are broader in scope with objectives to improve intelligence, to disrupt and deny the primary and alternate routes of shipment used by drug traffickers, and to seize and destroy illicit drugs at or near their source. NNBIS is also planning a number of future operations such as: special operations along the U.S. borders; coordinated, foreign in-country efforts; interoperable and secure command and control communications; an integrated, coordinated intelligence effort; and preparation of a joint operations plan.

Special operations are evaluated in "after-action" reports, which are often classified. In addition to comparatively high levels of seizures, major accomplishments described often include improvements in coordination and particular elements of the operation such as planning, intelligence, communications, and foreign country cooperation. Recommendations are made that are incorporated into plans for future special operations as well as the day-to-day operations of drug interdiction agencies.

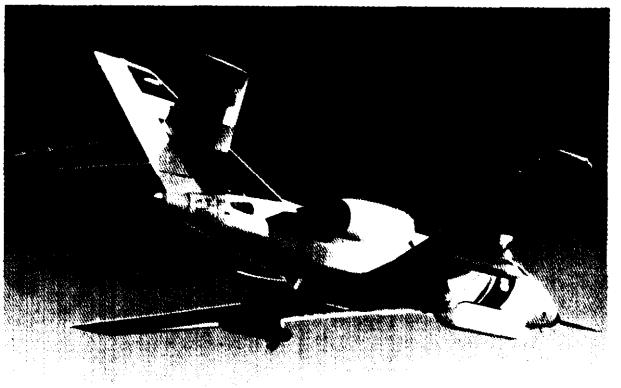


Photo credit: Aerojet Electro Systems

Several of the Coast Guard's medium-range surveillance aircraft are being fitted with a multi-sensor system for detecting suspect ships and boats.

INTERDICTION TECHNOLOGIES

The process of interdicting drug smugglers consists of five broad categories of activity: intelligence, command and control, surveillance, pursuit, and capture. Figure 11 illustrates the general nature of these activities.

Intelligence plays an important role throughout the interdiction process. Intelligence simplifies the separation of smugglers from legitimate traffic and may provide advanced information on departures, routes, destinations, and where drugs are hidden. Intelligence also provides information on the effects of interdiction activities on smugglers. Technologies for intelligence are not discussed in this report for security reasons, although the types of intelligence collected and the mechanisms for distribution are noted.

Command and control provides the mechanism to manage information about a potential target and to select, distribute, or display that needed for operational decisions. Data links, computer systems, and secure communications are important components and are key to effective command and control systems. Central command structures for operations involving more than one agency or branches of an agency are also essential to make effective use of command and control technologies.

Surveillance is the process of watching for and detecting potential targets. Surveillance technologies cover a broad spectrum from binoculars to advanced radar.

Pursuit is the process of tracking a suspected target either remotely or by close visual or sensor contact. The actual identification of a target is made by sighting, with or without the aid of sensors (some of which may be used for surveillance), and comparing distinguishing features, such as aircraft tail numbers and vessel names, with smuggler profiles and intelligence information obtained through computer databases and command and control systems.

Capture is the process of stopping and searching the suspect, seizing drugs, making arrests, and collecting evidence. Technologies for pursuit and capture are often the same, including airplanes, helicopters, ships, and land vehicles.

Interdiction at ports of entry involves these same basic activities, but is discussed separately since different technologies are used. Technologies to find drugs at ports of entry range from computer data systems and vapor detectors to probes (pointed metal rods).

Following is a summary of available and prospective technologies, their capabilities and limitations, and the capabilities and limitations of enforcement agencies in using technologies.

Generic Limitations

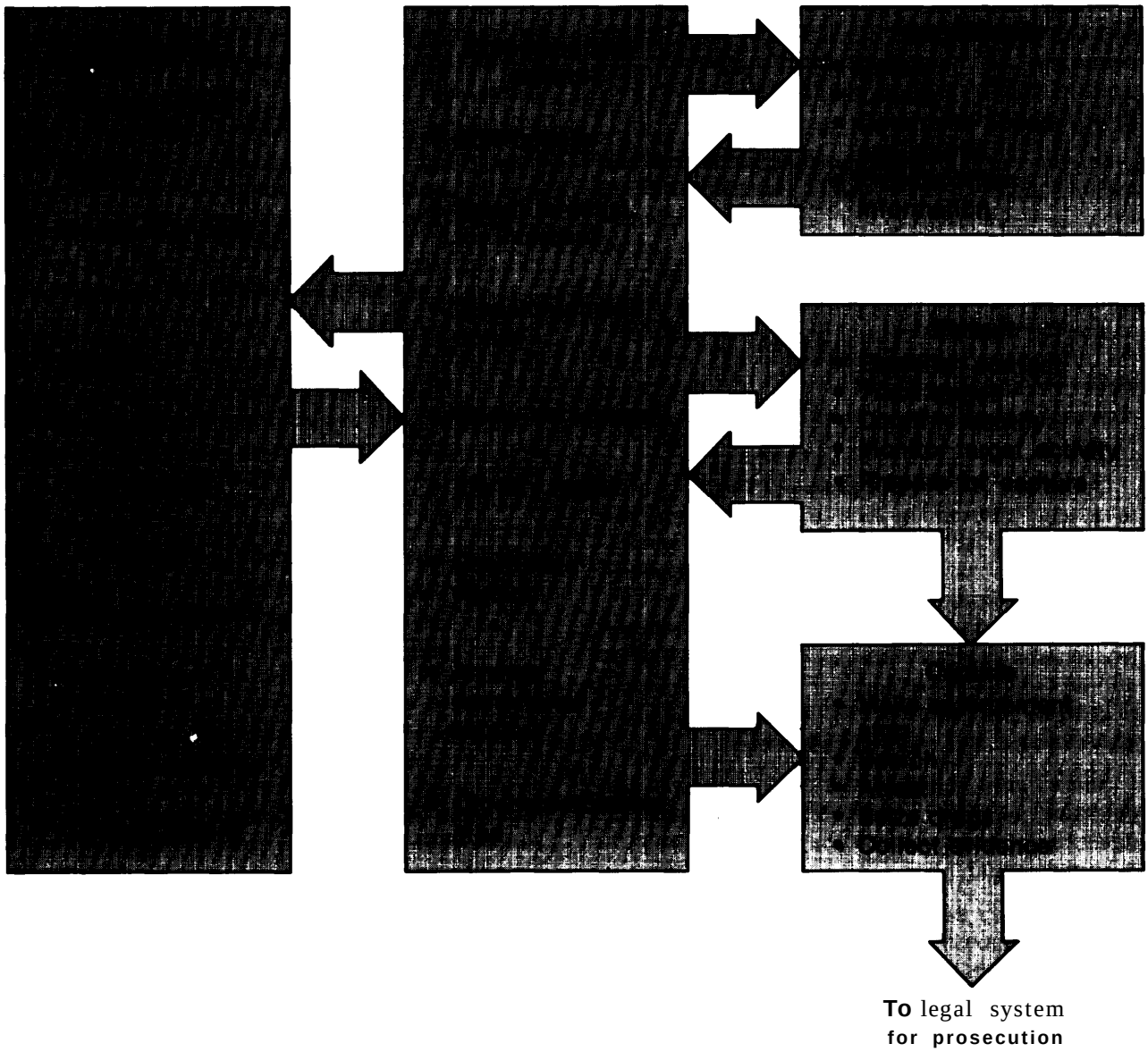
The contribution that technologies can make to drug interdiction is constrained by three generic factors. First, all technologies presently or potentially available have inherent limitations. For example, radars have range, discrimination, and reliability limitations. Airplanes have range and speed limitations. X-ray machines can detect only certain objects or abnormalities. Second, even the best technologies are no better than the organizational, human, and financial resources available to deploy them. For example, the best radar operated by an organization with limited funding and personnel is of little value during those periods when it is not in operation. Third, strategies for using technologies establish limitations. For example, the Air Force system disregards targets of greatest interest to law enforcement agencies. It is not that the radars fail to detect those airplanes. Rather, the Air Force has an information management problem with a massive number of aircraft entering the United States. The Air Force, thus, collects and uses only information directly relevant to its primary mission, and that is not drug interdiction. To give another example, the need to rapidly process individuals at ports of entry results in only limited use of technical aids that slow down processing.

Intelligence

The principal Federal agencies involved in drug interdiction operations have their own intelligence collection and analysis apparatus. Three kinds of intelligence information—strategic, tactical, and operational—support interdiction activities.

Strategic intelligence is collective information on all aspects of drug availability, use, abuse, cultivation, production, and smuggling. Such informa-

Figure II.—Interdiction Functions



SOURCE: Office of Technology Assessment, 1987.

tion provides a comprehensive overview of the drug environment. It is used to keep managers and policymakers advised on the drug situation, to make projections, and to provide a basis for decisions about resource deployments.

Tactical intelligence is immediate, actionable information on an anticipated drug smuggling activity that can be used as a basis for pre-positioning interdiction resources. DEA's El Paso Intelligence Center (EPIC) is primarily responsible for managing this type of information.

EPIC manages an extensive database on drug smuggling levels, routes, individuals, organizations, equipment, and seizures. Consolidated and evaluated intelligence information is disseminated in both hard copy and verbal form, as appropriate. Many

automated data systems maintained by individual agencies are accessible through EPIC. Such systems include information on suspect individuals, aircraft, boats, and vehicles.

Operational intelligence is systematically organized information on a specific active or potential drug smuggling individual or organization. The information relates to the individual target's activities, resources, and apparent vulnerabilities.

Intelligence is collected by special agents operating in source countries and the United States as well as by other methods. Communication of tactical and operational intelligence to interdiction agencies occurs through EPIC, NNBIS, and the individual agencies' command centers.

Some experts believe that the best prospects for increasing the effectiveness of the Federal drug interdiction program lie in expanding and improving the intelligence collection, consolidation, analysis, and dissemination process. According to a Customs' analysis of their 1985 seizures, prior information was used in a majority of large cocaine seizures, accounting for the bulk of the volume seized.

The current procedures for sharing time-sensitive intelligence data are sometimes cumbersome. The Customs Service and the Coast Guard each maintain and operate their own marine interdiction C^3I (command, control, communications and intelligence) centers; in fact, the Customs Service maintains separate marine and air interdiction C^3I centers. Separate Coast Guard, Customs, and DEA intelligence activities have created problems in coordination of operations on a day-to-day basis. These agencies do not always cooperate on collecting and distributing vital tactical intelligence, they cannot usually communicate on secure lines with each other, and information from the intelligence community is not always equally available to field units. A lack of intelligence flow could be a major impediment to effective use of any new C^3I technology to be developed in the future. The problem of secure communications was resolved for a recent special operation, but much remains to be done to incorporate this progress into routine operations.



Photo credit: Border Patrol

Command and control centers are the key to effective use of modern sensor technology for interdiction.

Command and Control

Effective drug interdiction requires the capability for rapid information exchange and reliable, secure, and quick command and control of operational units. The Customs Air Branch, Customs Marine Branch and Coast Guard each have their own command and control centers and networks. The Coast Guard has a nationwide command system that is probably the most comprehensive in coverage. Customs Air Branch has four operating centers. Three of these (in Miami, Houston, and Albuquerque) are colocated with the FAA air traffic control centers and the fourth is at the Regional Operations Control Center, March Air Force Base, Riverside, California. In 1986, the Customs' Marine Branch initiated a new center in Miami. There are many opportunities for technological improvements (data handling, sorting and analysis, display, etc.) in all the centers but the most serious deficiency is that a working plan for coordinated operations and command is not in place. Customs has initiated the development of new C^3I centers and the 1986 Anti-Drug Abuse Act calls for the several agencies to cooperate on a center design.

The technologies available to provide secure voice communications, which cannot be monitored by drug smugglers, are generally unsatisfactory but

slowly improving. None of the individual agencies appear to have the kind of technology for information exchange and command and control that they believe to be necessary. The problems in some instances are lack of resources to procure the necessary secure communications technology. In addition, each of the agencies tends to have its own communication equipment and standard operating frequencies that are often incompatible. The problem is a particularly serious one in terms of the ability of operational units of the various agencies to communicate with each other. Even when there are coordinated command and control centers such as that represented by the Blue Lightning Operations Center in Miami, incompatible communication equipment sometimes precludes the Center from communicating with operational units. During recent special operations, military equipment was used to resolve this problem. But, there may be higher priority national security concerns that would preclude the use of this military equipment for routine drug law enforcement.



Photo credit: Westinghouse, TCOM

A surveillance radar is mounted on this large, tethered balloon to detect low-altitude smuggler aircraft.

Surveillance

Aircraft

The Nation's largest civilian aircraft surveillance system is operated by the Federal Aviation Administration. This system provides two types of radar coverage: control over airport approaches and departures, and surveillance of flights between airports (the en-route system). The en-route system covers virtually all of the continental United States, but generally at altitudes above 10,000 feet and with almost no coverage below 5,000 feet. The FAA radar system provides a basic map of the Nation's air traffic including all flights operating on instrument flight rule (IFR) plans. Its value to interdiction is primarily in detecting, and separating out, many planes not likely to be smugglers, since smugglers normally fly below 1,000 feet and without flight plans. However, the altitude band below 10,000 feet also contains large numbers of general aviation aircraft operating on visual flight rules, flights that are very difficult to distinguish from smugglers by means of radar.

The Customs Service seeks detection of smugglers through the FAA radar network, equipment under its own control, and equipment operated by DOD agencies.

One recent addition to Customs' surveillance capability is an aerostat-mounted radar (a tethered balloon supporting a radar antenna) in the Bahamas. This radar provides Customs with surveillance of the Bahamas and the northeastern reaches of the straits of Florida and has enhanced detection of flights coming through this area bound for Florida. Customs plans to add additional aerostat radars along the Mexican border as well.

Customs also operates radar surveillance aircraft. In addition to their surveillance capability, some of these aircraft can lock on and track targets. On a recurrent basis, Navy surveillance aircraft provide support during regular training and routine patrol flights. On occasion, they fly designated surveillance missions at the express request of Customs. During 1985 Navy aircraft flew several hundred sortees for Customs. The Air Force's airborne warning and control system (AWACS) aircraft provide similar support to Customs.

There is also a Navy radar at Guantanamo Bay, Cuba, which provides surveillance of air and surface targets. Air Force operated aerostat-mounted radar at two locations in Florida provide both air and surface target information. Information from

these systems is shared with the Coast Guard and Customs Service.

As extensive as this coverage may appear, it has many limitations. Large areas of the southern border have no radar coverage under certain conditions and at certain times. Even where radar coverage is available from the FAA, it can seldom pick up airplanes flying at the altitudes normally used by drug smugglers. The aerostats and the various airborne radar platforms available to Customs cover relatively small areas, albeit corridors of heavy drug traffic, and their coverage is not continuous.

Improved radars with longer ranges and greater detection capability could contribute to interdiction. Similarly, operation of more radars or existing radars for longer periods of time could enhance interdiction. Providing continuous coverage of all possible smuggling corridors by airborne radar would be very expensive, assuming that the equipment could be made available at all. A possible alternative to designing a radar surveillance barrier is to develop an approach similar to a military air defense system that provides increasing levels of detection, identification, and tracking of targets as they approach U.S. borders.

Perhaps a significant improvement in long-range and wide coverage radar surveillance of the Southern border could be added when DOD installs the planned south-looking, over-the-horizon (OTH) radar in the 1990s. This radar could provide nearly complete coverage of the Caribbean and Gulf of Mexico, at least in theory. If it is to be used for drug interdiction purposes, however, there is a need to incorporate certain special features into the system, and provide links to transmit data to the appropriate drug enforcement agencies. Alternatively, it may be possible to develop a dedicated OTH system for detection of smuggler aircraft.

In sum, existing capabilities for surveillance and detection of smuggler aircraft are limited over most of the Southern border. Increases in this capability are planned but, with present uncertain knowledge about trends in the air threat, it does not appear wise to invest in a large fixed radar barrier. Rather, it may be more prudent to make incremental improvements, make use of existing defense programs, and gain more insight on future smuggling patterns. Flexibility is necessary in responding to any specific current threat.

Vessels

Surveillance of vessels smuggling drugs into the United States is being modified to use a wide variety of technologies,

Airborne sensor systems, mounted on fixed-wing aircraft or helicopters, are either now in use or being brought into operation by the Coast Guard. Surveillance radars are mounted on two types of aircraft. In addition, the Coast Guard has forward-looking infrared systems, and a new multi-sensor surveillance package known as AIREYE is being evaluated. AIREYE has the potential capability of both wide area surface search by radar and short-range target identification using a laser-enhanced TV.

The Coast Guard has tested aerostat-mounted radars tethered to ships which provides long-range surface search capability. The Coast Guard plans to acquire several of these systems principally for the purpose of locating suspect vessels in the channels and passages between South America and the U.S. coast. Finally, the Coast Guard uses its medium- and long-range aircraft and helicopters for radar and visual surveillance of suspected drug smuggling vessels. Some have advocated that, in the future, the Coast Guard could also contribute to surveillance and tracking of private aircraft smuggling since many Coast Guard missions in the Caribbean operate over the same regions known to be air smuggling routes.

The surveillance technologies used by the Customs Service to detect vessels suspected of smuggling drugs—mainly in coastal and inland waters—roughly parallel but are more limited in scope and coverage than those used by the Coast Guard. Coast Guard surveillance technologies, at times, generate data which are provided to Customs.

The Customs Marine Branch also operates its own radars. It has installed a few radars on the tops of tall buildings and towers in south Florida and plans to add more in Florida and along the Gulf Coast. It also has small vessels equipped with surface search radars.

The limitations of marine surveillance technologies are similar to those used for air surveillance. Both the Coast Guard and the Customs Service are investigating improved technologies. The goal is to provide more extended and/or more discriminat-

ing coverage for longer periods of time and for reasonable costs. None of the proposals for new technologies, however, offer the likely prospect of a fundamental breakthrough. Rather, they offer incremental improvements.

Land Border

The Border Patrol uses a variety of technologies on the Mexican border to detect illegal intrusions. There are a large number of unmanned sensing devices linked to computer-equipped base stations that can direct Patrol officers to investigate intrusions. Sensors include several types. Buried seismic sensors detect soil disturbances created by intruders. Magnetic sensors detect metal in the small amounts carried by people, while magnetic vehicle direction sensors detect the presence and direction of vehicles. Infrared sensors detect heat emissions from humans or animals. A number of manned infrared systems for vehicles and persons are also in use. The Patrol also has night vision goggles and pocket-sized starlight scopes. Low-light-level television systems are installed on the Mexican border and more are planned. The Border Patrol uses cars, trucks, and other types of land transportation. It also has fixed-wing airplanes and helicopters for visual surveillance. Plans are for forward-looking infra-red systems to be mounted on some helicopters. The Patrol is also testing four-wheel drive vehicles outfitted with either an infra-red imaging device or a low-light-level camera TV mounted on a telescoping mast that can extend in the air.

None of the devices used by the Border Patrol has the capability of discriminating drug smugglers from the millions of other intruders that come across the Mexican border.



Photo credit: Border Patrol

The Border Patrol has developed imaging sensors for use on vehicles that can patrol the rough terrain of the Mexican border.

Pursuit and Capture

Aircraft

The Customs Air Branch uses aircraft for interception, tracking, and apprehension of drug smugglers. The desired capabilities for tracking and intercept airplanes relate to cruise speed, capacity to stay aloft without refueling for a set amount of time, and adequate sensor equipment such as radars and infrared sensors to allow for tracking smugglers at night without making visual contact. Customs expects to have several aircraft that meet these criteria.

The Air Branch presently has a few aircraft with the requisite sensor capabilities and speed, but their endurance is more limited. Customs also has other types of aircraft for tracking, but they are not equipped with radar and must rely on ground controllers or visual intercept methods. Once on the trail of a suspected drug smuggler, however, these aircraft do have forward-looking infra-red detection systems that allow them to follow suspected drug smugglers. Finally, the Air Branch has a support fleet of other twin-engine, single-engine, and rotary-wing aircraft (none of which have special sensor equipment) that are used for daylight operations. Suspicious aircraft can be checked against data systems with information on flight plans, stolen aircraft, etc.

All Customs airplanes can be used in the task of apprehension where no specially equipped aircraft are available or within range of the arrest site. The most effective aircraft for arrest, however, are Black Hawk helicopters acquired from the Army. Of all of the aircraft in its inventory, Customs has found the Black Hawk to be particularly effective for apprehension. It has the speed and range needed and is equipped with night vision goggles for the aircrew and a powerful search light. Also, the Black Hawk has a large cabin that accommodates an arrest team in addition to the pilot and co-pilot.

The air interdiction resources of the Customs Service are clearly limited. First, Customs has a very small number of aircraft to cover border areas. Second, only a few Customs aircraft have the necessary performance characteristics—speed, range, and sensor equipment. The challenge faced by the Air Branch can be perceived when one remembers that 3.5 to 10 smuggling flights cross the Southern border every day.

Vessels

Some of the vessels used by the Coast Guard and the Marine Branch of the Customs Service for pursuit and arrest differ significantly. The Coast Guard uses vessels that give it greater fire power and longer endurance. Further, the Coast Guard is required to advertise its presence. Coast Guard vessels are clearly identifiable. By comparison, the Marine Branch of Customs relies on vessels which are small, high speed, and capable of only brief sorties. Most have no distinctive insignia since Customs relies more heavily on blending in with other boating traffic.

Coast Guard cutters and patrol boats carry a variety of sensors used to identify vessels suspected of drug smuggling. These include ship-mounted radars and small optical sensors and night vision devices. The Coast Guard has under development an electro-optical sensor system to be mounted on its cutters. Its role is to enhance the capability for identifying vessels during darkness or periods of poor visibility. In addition, Coast Guard vessels have night vision scopes and gyro-stabilized binoculars, plus scanners for both VHF and UHF radio transmissions. Most cutters have been recently fitted with secure voice radio systems to protect their communications from monitoring by smugglers.

For the capture of drug smuggling vessels at sea, the Coast Guard mainly uses its cutters and patrol boats plus some special vessels such as its surface effect craft fleet and the Navy's hydrofoil fleet out of Key West, Florida. The Coast Guard also sends drug interdiction teams on board a variety of larger Navy combatant ships when available. Coast Guard vessels are designed for ruggedness, endurance, multi-mission capability, and ease of operation. These characteristics give the Coast Guard a number of advantages that sometimes compensate for relative lack of speed compared to many smuggling vessels. For example, when the seas build up, a larger "slow' Coast Guard cutter can often catch a "go-fast boat' which must slow down. The Coast Guard also uses some portion of its small boat fleet stationed along the entire U.S. coastline.

Customs, by comparison, uses small fast boats that are dedicated to drug missions. Customs plans to have several new interceptors outfitted with radar. Since Customs seeks vessels that blend in with other boats, they generally use designs that are already commercially available. Customs has on order several high-speed catamarans that it believes will offer greater maneuverability, tighter turning, and better stability in rough seas than the boats used by smugglers. These are meant to be used in a chase boat strategy.

Both Customs and Coast Guard must make critical judgments about where to place limited num-



Photo credit: **US.** *Customs Service*

Customs' high-speed interceptors operate in coastal waters such as south Florida where smugglers attempt to dash from offshore islands to secluded coves on the mainland.

bers of vessels or patrols and other apprehension resources. Many areas are left unpatrolled, and thus may be open to smugglers, resulting in no knowledge of their activities. The recent change in smuggler tactics by using air drops at night to small vessels stationed offshore makes the problem very difficult. Customs also suffers from a lack of trained boat operators especially since they have recently acquired a large number of new vessels.

Finally, the Coast Guard has worked with Customs to develop a variety of sensors used to find hidden compartments on vessels that may be used for drug smuggling. Much of this equipment was developed for Customs to find drugs at ports of entry.

Detection at Ports of Entry

Customs uses a variety of technical aids to help meet the two goals of detecting drugs at ports of entry while simultaneously moving legitimate traffic rapidly through the inspection process.

The TECS (Treasury Enforcement Communication System) database provides information on specific individuals, vehicles, private aircraft, and vessels suspected of smuggling or other illegal operations. TECS terminals are available at all ports of entry, but their use is limited by the time required for entering data and by maintenance problems. These problems are being addressed by programs aimed at development of an automatic passport reader, an automatic license plate reader, and equipment replacement. However, such problems as the time and personnel requirements for entry of names of individuals carrying foreign passports have not been solved by these innovations.

A computer database for cargo is operational at a few ports and under development at others. At most ports, manifest and invoice information are manually compared with profile data on importers, commodities, manufacturers, and countries of origin. About 20 percent of the cargo entering the United States is identified as high risk (for all purposes, not just drugs). Roughly 3 percent of high risk cargo is subjected to an intensive enforcement examination. The remaining high risk cargo receives a brief compliance examination where one or more items are inspected. Only documents are reviewed for the 80 percent of cargo that is not considered to be a high risk. The development of expert systems offers the prospect of refining cargo selectivity by facilitating the transfer of individual inspector knowledge and developing risk rankings and inspection priorities.

The range and quantity of equipment used to detect drugs at ports of entry is quite limited. At present there are several parcel X-ray systems used primarily to inspect airport baggage, a few X-ray systems located at mail examination facilities, a few sets of special probes, several fiberscopes, and ultrasonic range finders. Wind tunnels (vapor detectors) will soon be installed at an airport to screen passengers. In addition, major ports of entry have specially trained dogs to detect drugs. While dogs are capable of directly detecting scents from drugs, most tools in use only indicate abnormalities in materials or detect chemicals associated with drugs. In all cases, manual inspection is necessary to verify the presence of drugs.

The Customs Service continues to investigate a range of more advanced detection technologies, but few have been found that meet the requirements of Customs inspectors. Two critical requirements are speed of operation and accuracy (low false-alarm rate), since inspectors must facilitate traffic through the ports of entry in addition to enforcing drug laws. Further, the technologies must be acceptable to the inspectors, that is, they must have the characteristics of ease of operation, durability, and compatibility with normal working techniques.

Significantly different technologies and strategies will be required for anything more than an incremental improvement in drug seizures. However, Customs has inadequate funds for the new technology development needed to support port-of-entry drug interdiction functions. Available resources are very limited for developing innovative approaches to detection and testing and refining commercially available devices. Perhaps the greatest deficiency is the lack of funding for studies of the chemical and physical properties of drugs.

Customs is pursuing technological developments in three areas that would be especially helpful for drug interdiction at ports of entry. First, technologies that speed the inspection process. One example is advance manifest systems for cargo. Such systems allow Customs to select what will be inspected prior to arrival and low risk cargo can be electron-

ically released. Second, technologies are needed that can detect drugs. Work is well underway on a nuclear magnetic resonance system designed to detect heroin and cocaine in letter mail. Most vapor approaches have been limited by technical problems associated with obtaining a sample from concealed drugs. Third, technologies are needed that can more effectively detect hidden compartments. One example being investigated is an imaging gamma backscatter detector designed to identify abnormalities in materials,

A critical need of Customs inspectors is the ability to select people and parcels to inspect. Profiles are the primary means used for selecting people and cargo for detailed inspection. Data systems and analyses that would quickly respond to the changing profiles of drug smugglers and drug smuggling techniques could potentially be very useful. There are opportunities for improving selection techniques and some are being pursued. These may enable Customs to improve interdiction rates but a statistical database to measure these improvements is not now available. It would be essential to have such a measurement system in effect both before and after new techniques are deployed to evaluate their effectiveness.

FINDINGS

Major findings fall into four general categories: inadequate direction; data deficiencies; coordination problems; and technological limitations. These categories are described below.

Inadequate Direction

The Nation drug interdiction efforts suffer from a lack of clear direction.

Such direction is necessary for assuring that available resources are devoted to the highest priority problems. It is also necessary if the various agencies are to design and carry out effective, coordinated interdiction strategies.

Individual enforcement agencies have generally chosen those interdiction goals that they are best organized and equipped to accomplish. For example, route denial is a goal of the Coast Guard, but no attempt is made to evaluate the ease or difficulty of a smuggler changing routes or modes if one of many is closed. More attention to priorities is essential when faced with a situation where the problems are much greater than the resources available.

A goal of interdiction is a reduction in illegal traffic-i.e., the total quantity of illegal drugs that are imported. While this goal appears simple, it is considered, by most, impossible to measure accurately. Which actions would best lead toward that goal is also a matter of considerable debate. Some believe that since international narcotics traffickers are immensely wealthy and powerful criminal organizations, the law enforcement effort should be focused on apprehending the leaders, breaking up the groups, and seizing their assets. In this way, a sizable reduction in smuggling would logically result. Others believe that seizing drugs would be more effective since this would force prices up and reduce demand. This debate about cause and effect has left individual agencies to sometimes stress individual goals. This highlights the need for more central direction.



Photo credit: U.S. Coast Guard



Photo credit: Border Patrol

Measures of effectiveness for interdiction are difficult, if not impossible, to quantify. One commonly stated interdiction measurement has been total drug seizures or seizure rates. While seizure quantities can be easily collected, they are difficult to interpret. No seizures may indicate great success—that drugs are no longer being smuggled through a particular location. Or, a lack of seizures may indicate that smugglers are circumventing interdiction efforts. In fact, the limited seizure and trafficking data available indicate seizures increasing as smuggling increases, Agencies have not attempted to rou-

tinely collect or analyze information that would help to evaluate interdiction strategies or technologies.

Data Deficiencies

Data on drug smuggling, the trafficking system, and interdiction programs are inadequate to make informed selection of best strategies, optimum allocation of enforcement resources, and technical design and management decisions for the future.

Trafficking Data

Present estimates of the quantity of drugs coming into the United States and their means of transport are based on conflicting data. Prior year estimates of total quantities being smuggled are made annually by the National Narcotics Intelligence Consumers Committee (NNICC) and are derived from estimates of source country production, analyses of data on seizures accumulated on a year-by-year basis, and analyses of drug consumption indicators. The U.S. Customs Service makes l-year projections of the drug smuggling threat. The estimates from NNICC (which consists of 11 Federal agencies) and the Customs estimate rarely agree and they do not attempt to make year-to-year or retrospective analyses.

Seizure Data

Data on drug seizures are collected and compiled in a variety of ways by each agency involved. The El Paso Intelligence Center (EPIC) is the repository of seizure data from all sources but, because of agency differences over credit for seizures, EPIC never identifies the agency responsible for seizures. OTA was unable to resolve a number of conflicts and contradictions between seizure data provided by various agencies. Some of the reasons for contradictory data appear to be double-counting and differing standards of estimating. The double-counting problem may have been eliminated by a new system initiated in October 1986. However the data available cannot be reliably attributed to specific interdiction efforts by individual programs or agencies.

Price Data

Data on drug prices are collected by the Drug Enforcement Administration (DEA) and appear to be consistent and reliable. OTA could not find any agency making analytical use of price data to provide indicators of the effect of law enforcement efforts. In the past, price/purity data were used as goals and measurement of success. While such a measurement is vague, it has at least as much value as seizures.

Sampling Techniques

Neither Coast Guard nor Customs Service has made systematic use of statistical sampling techniques to project the levels of drug trafficking and evaluate the effectiveness of interdiction technologies and strategies. No data are collected with that end use in mind.

Data Collection

Reliable and consistent data can contribute both to effective resource allocation and to the agencies' operational interdiction strategies. To be most useful, the appropriate information must be collected in a form consistent across agencies and time, and subjected to consistent, continuing analysis. One example of the data problem can be found at ports where customs inspectors report drug seizures on a common form. At present, this information has little use except totalling the number and quantity of seizures. The forms do not include accessible information on why or how the inspection leading to seizure occurred. Possible reasons include: prior intelligence, the courier or cargo fit a suspect profile, or the inspection was random. Analysis of such information could indicate areas of high payoff.

Coordination Problems

Fragmented command, control, and jurisdictional responsibilities characterize the Federal drug interdiction enterprise and are a major impediment to the adoption of existing and new technologies for drug interdiction.

Headquarters Coordination

Problems with interagency coordination and cooperation exist at every level. At the Washington level, coordination is facilitated by such groups as the Drug Enforcement Policy Board chaired by the Attorney General and the National Narcotics Border Interdiction System (NNBIS) chaired by the

Vice President. Coordination and cooperation occur through meetings and the development of consensus, Decisionmaking, however, is usually slow. Very little comprehensive planning is done—e.g., setting priorities among agencies or development of strategies needed for total interdiction system designs.

Regional Coordination

Regional NNBIS groups have been established in seven locations. They include representatives of the regional offices of drug enforcement agencies. The degree of cooperation and coordination through NNBIS is good in some regions and poor in others.

Operational Coordination

At the operational level there are a diversity of mechanisms used to facilitate cooperation and coordination among drug enforcement agencies. Successful cooperation and coordination generally rests on specific arrangements made by the officials in charge of regional enforcement units. Impediments to cooperation and coordination at the regional level are several. Each agency has its own structure, goals, operating style, and communication system. For example, the Coast Guard and the Marine Branch of the Customs Service use different communication frequencies, so operational units cannot communicate directly with each other. Even in the case of the marine operational system, the Blue Lightning Operations Center in Miami, conceptually a joint Customs-Coast Guard command and control center, there is not yet a capacity to communicate directly with Coast Guard vessels.

Multi-Mission Agencies

The multiple and sometimes conflicting operational goals of agencies impede cooperation and coordination. The agencies responsible for interdiction have other important responsibilities. The Drug Enforcement Administration emphasizes eradication, investigation, arrest, and conviction of key drug smugglers. DEA also has a major role in providing intelligence for interdiction.

Shared Jurisdiction

Because both Coast Guard and Customs share responsibility for marine interdiction within the 12-mile zone, very close cooperation is necessary for efficient operation. When this cooperation and coordination is lacking, present interdiction efforts suffer.

Technology Operations

With the introduction of new long-range surveillance systems that are capable of locating both air and sea potential targets, opportunities exist to centralize the operation of these systems in one agency and the need for much improved coordination and cooperation becomes even greater.

Technological Limitations

No single existing or potential technology has been identified that would, by its simple addition, solve the Nation overall drug interdiction problem. Many opportunities exist for technologies to make incremental contributions to the Nation interdiction program. These opportunities rang-e from improvement in technical performance, to procurement of increased numbers of existing technologies, to more effective use of technologies, to development of new, advanced systems.

Whenever technological improvements result in more effective interdiction, the drug traffickers will take rapid and, based on their record, effective actions to neutralize that effectiveness. These actions can range from changing smuggling routes and/or modes of transport to the use of countermeasures.

The contribution to drug interdiction from all existing and proposed technologies is ***limited by three factors: 1) inherent technical limitations (e.g. range, discrimination, speed); 2) the personnel, training, and financial resources to utilize and maintain the technologies in an optimal way; and 3) the strategies and operational procedures which govern the use of the technology.***

No Single Technology Solution

Single technologies may be very effective in stopping smuggler's from using one mode of transport for a particular drug, but smugglers will likely respond by shifting to another transport mode. For example, a nuclear magnetic resonance (NMR) device developed by Customs can detect certain drugs within small packages directly. It may be used to

search all letter mail for smuggling cocaine and heroin. But there remain many ways to smuggle these drugs that are not easily detected with current or emerging technologies. As another example, installing an "acoustic fence' at marine choke points could help prevent the use of such routes by marijuana smugglers, but without other measures to place pressure on other routes or modes of transport, the availability of imported marijuana is not likely to change over the long term. Some individual technologies may be useful in sorting potential smuggling targets, but may have a high false alarm rate. Use of additional sensors in a multiple screening system could potentially help reduce the false alarms to a manageable level.

Limited R&D

None of the drug interdiction agencies has significant financial, organizational, or personnel resources devoted specifically to developing drug interdiction technologies. Without a comprehensive development, test, and evaluation program for major technologies, future performance will be questionable and resources may be wasted.

Needed Test and Evaluation

Many recently acquired technologies devoted to border interdiction by the drug law enforcement agencies are not yet deployed operationally and have not been integrated into an effective, comprehensive system designed to counter the formidable threat posed by international narcotics traffickers. These new technologies require considerable operational evaluations, operator training, and an overall system design before their potential can be realized. Most new systems have not had sufficient field testing to make judgments about their effectiveness. Lacking a uniform and comprehensive approach for the total Federal effort, each new sensor, platform, or other technology will have only limited future impact.

Limited Technologies to Date

Most of the field operators of the agencies involved in drug interdiction to date have had limited technologies beyond basic vehicles, sensors, and simple inspection tools for carrying out the very labor-intensive tasks required. Success in drug interdiction in recent years has usually resulted from hard work rather than technological advances.

Many Technologies Available for Enhancing Specific Capabilities

There are a number of technologies and technological systems that are not now in routine/general use and have the potential of enhancing Federal drug interdiction efforts. Among these are: modern airborne radar systems for both air and sea surveillance (e. g., APS-137, APS-138); tethered Aerostat (balloon) borne radars, both land- and ship-based for both air and surface surveillance; integrated airborne sensor systems such as Coast Guard's AIREYE—including radar, infrared and laser enhanced TV; over-the-horizon radar systems that could provide thousands of miles of coverage from one land-based station; remotely piloted vehicles with advanced infrared and optical sensors for surveillance; acoustic sensing systems for ship detection; long-line, land border, intrusion sensors using seismic or other techniques under development; high-performance vehicles (air, land, and sea) for tracking and apprehension of suspected smugglers; improved X-ray and other nondestructive devices for inspection of cargo and baggage at ports: and *advanced* vapor analysis systems for finding drugs carried by persons or in baggage and cargo.

The list of specific technological improvements is so long and so interconnected that no single or even small group of equipment can be adopted effectively without a total system design. For a surveillance and detection technology to be effective, both a command and control network strategy for apprehension is needed first. For a baggage inspection device to be effective a system for selecting and handling the huge flow of goods to be inspected is needed. A fixed system directed at one aspect of the drug trafficking threat will not be effective for very long when the smuggler has the option of rapidly switching tactics. Federal decisions on basic strategies and comprehensive system designs have not been made to the extent necessary for a cost-effective and appropriate selection of new technologies for future drug wars.

Opportunities for Enhanced Surveillance

When considering the problem of smuggling across borders outside of official ports of entry, the

greatest opportunity for enhanced technological capabilities is in the area of surveillance of aircraft, vessels and other vehicles.

- Radar coverage of the Nation's Southern border that is capable of detecting aircraft used for smuggling is very limited. First, most general surveillance radar are not capable of detecting aircraft flying at low altitudes and slow speeds. Smugglers fly at low altitudes and slow speeds precisely to take advantage of this limited radar coverage. Second, some areas of the Southern border have no radar coverage. Third, in those limited areas where appropriate radar capabilities exist, surveillance is not continuous. Intermittent surveillance results from: limited personnel to operate ground-based radar, the relatively short endurance of aircraft with surveillance radar, and the fact that fixed aerostat-mounted radars can be easily seen and avoided by smuggler aircraft.
- Desired air and surface surveillance capabilities would have: 1) broad area coverage, 2) long-distance detection (maximize lead time for mobilizing pursuit and capture forces), 3) maximum capability for discrimination among aircraft or vessels (size, speed, etc.), and 4) enhanced short-range sensors for inspection of vessels.
- Among the currently available surveillance systems, aerostat-mounted radar is particularly attractive for filling low-altitude gaps at borders and for extending sea surveillance coverage offshore. Advanced airborne radars are attractive for providing long-range coverage and flexibility of deployment. Over the longer term, comprehensive surveillance coverage of the Nation's Southern border may be available from over-the-horizon radar and a zone defense approach to the network design.
- Surveillance capability provided by Air Force and Navy airplanes and Navy vessels has the potential for contributing to the effectiveness of drug interdiction. However, military equipment and operators are not always suited to the drug enforcement mission; equipment modifications and personnel training is often necessary. DOD surveillance of potential smugglers is necessarily at a much lower priority than is national security.

Pursuit and Capture Technologies

Effective pursuit and capture of suspected drug smugglers, whether in aircraft or vessels, is significantly improved with good intelligence, identification, and target selection information. Pursuit and capture is always a time-constrained activity. Early information, which allows for longer periods to mobilize pursuit and capture forces, and good information on the routes and, ideally, the destination of smuggling aircraft and vessels, is invaluable to effective pursuit and capture. Technologies are presently available that meet most of the requirements each of the interdiction agencies have identified as necessary to carry out pursuit and capture functions. The primary technological constraint on pursuit and capture effectiveness is associated with the limited number of available platforms or vehicles with appropriate capabilities.

- The Customs Service has defined the desired pursuit aircraft as one with an endurance of 8 hours, detection equipment (radar and infrared sensors) that allows smuggling aircraft to be pursued without being aware of it, and sufficient capacity to carry a bust team. Customs has found the Black Hawk helicopter to be very suitable for most capture missions.
- The Customs' Marine Branch generally relies on pursuit and capture technologies that involve minimally two boats: one with radar capabilities that are used to direct the other—a high-speed interceptor—to the target. The Customs' Marine Branch has sizable numbers of these vessels only in south Florida and even here is severely hampered by a lack of trained operators.
- Coast Guard technologies are designed to support that organization's multiple missions. The primary limitation of Coast Guard technical capabilities for pursuit and capture is available vessels. The vessels used for pursuit and capture are mostly the same vessels used for surveillance. The Navy (especially the hydrofoil fleet) has provided significant support to the Coast Guard's pursuit and capture mission. New Coast Guard patrol boats with advanced capabilities are just now entering the fleet.

Command and Control

Command and control capabilities and the technologies that support those capabilities are to a greater or lesser extent a problem for all enforcement agencies. Command and control technologies that provide a capability for coordinated drug interdiction activities among the various agencies are seriously deficient and most believe that they need to be improved before the potential for either surveillance or pursuit and capture technologies can be realized.

- Some continuing deficiencies pervade the area of command and control. First, all enforcement agencies are deficient in secure voice communication systems and the agencies have yet to devise an adequate system using compatible frequencies. Second, no single command strategy has been devised that would make a comprehensive system design practical. Third, the centers that are in use are deficient in sensor capability and have yet to evaluate their operational effectiveness to determine changes needed for optimum future designs.

Technological Needs at Ports-of-Entry

The technology used to support drug interdiction at ports of entry is limited in its availability and, in some categories, its capability. Port detection technologies divide into two categories: 1) those that provide capability for managing data; and 2) those that support detection of drugs on persons, in baggage, in cargo, in mail, or concealed in carriers (i. e., land vehicles, aircraft, or vessels).

- Data management and analysis technologies are in limited use at ports of entry. These technologies have the capability of providing information on both individuals and cargo useful to drug interdiction. Customs is making increasing use of data management and analysis technologies. Resources are the primary limitation.
- Most of the technologies both in use and being investigated to support the direct detection of drugs have serious technical limitations. One category identifies anomalies where drugs may be hidden. Another category detects either by sensing chemicals associated with drugs or directly sensing the drugs. Many technologies are considered unsatisfactory because they have high false alarm rates. Limited personnel resources cause Customs to reject technologies with false alarm rates that are higher than the ability of the inspectors to conduct detailed manual searches without disrupting movement of port traffic.
- Resources available to Customs are insufficient to allow systematic investigation of the potential for technical aids to enhance port inspection. Major deficiencies include:
  - —Basic information on the physical and chemical characteristics of drugs is not available to permit the evaluation of detection technologies used for other substances.
  - —Inspection resources are often not available for a comprehensive evaluation of new detection technology effectiveness.
  - —Efforts have not addressed multiple sensor systems to minimize false alarms. They have focused primarily on the development of single technologies.
  - —Limited training of inspectors has resulted in some available equipment not being utilized. Newly developed sophisticated inspection equipment must be designed to be user-friendly.
- Technology for detection of drugs at ports of entry could probably be advanced with a consistent and long-range R&D program. Such a program would need to include adequate staff; continuing programs to characterize fundamental properties of drugs, technology transfer, and equipment loans; mechanisms for getting information on how drugs are smuggled through ports of entry, stimulating fresh ideas or R&D approaches; and adequate facilities and resources to test and refine new systems.

Land Border Technologies

A range of technologies are in use and being investigated by the Border Patrol to support the identification of illegal intrusions across the Mexican border, Drug interdiction is made enormously more difficult because of the large numbers of illegal aliens continuously crossing the border. The sensors in use generally perform well but apprehension of suspects is very labor-intensive and no tech-

nologies will alleviate the basic need for more personnel to pursue and capture.

- There are currently available technologies for land border interdiction that could increase agency capabilities. Technologies and systems of interest include ground radar, remotely piloted vehicles (RPVS), aerostats and airships, buried line sensors, and infrared improvements.

APPENDIX A

ANTI-DRUG ABUSE ACT OF 1986, PUBLIC LAW 99-570 (OCT. 27, 1986) OTA SELECTED SUMMARY OF INTERDICTION PROVISIONS

Title III—Interdiction

Subtitle A—Department of Defense Drug Interdiction Assistance

Section 3052—Authorization.—Funds authorized to be appropriated to DOD for Fiscal Year 1987 for enhancement of drug interdiction:

- **$138** million for refurbishment and upgrading of four E-2C Hawkeye aircraft, or any other Navy aircraft which the Secretary considers better suited to perform the interdiction mission; and for the procurement of four replacement aircraft of the same type and related spares for the Navy;
- $99.5 million for procurement of seven aerostats; and
- **$40 million** for procurement of eight Blackhawk helicopters.

Two of the Hawkeyes (or whatever aircraft is chosen) are to be made available on loan to Customs, and the other two to the Coast Guard. Customs and Coast Guard shall be responsible for operation and maintenance costs.

The agencies that will be in charge of the aerostats and helicopters are to be designated by the Chairman of the National Drug Enforcement Policy Board.

The equipment procured under this Act may be obligated for enhancement of drug enforcement activities only if it is fully supportable within the existing service support system of DOD, and it reasonably related to an existing military, war reserve, or mobilization requirement.

Section 3053—Coast Guard Activities.—The Navy shall transfer $15 million from Fiscal Year 1987 O&M appropriations to the Secretary of Transportation to be available for members of the Coast Guard assigned to duty on Navy vessels.

The Fiscal Year 1987 active duty strength level for the Coast Guard is increased by 500 above any number otherwise provided by law.

A new section is added to Title 10 Chapter 18 U.S.C. providing that for each fiscal year, no fewer than 500 active duty personnel of the Coast Guard trained in law enforcement shall be assigned on board appropriate surface naval vessels, with the power to make arrests and carry out searches and seizures. (Such personnel may be assigned other duties if it is determined that there are insufficient naval vessels available.)

Forty-five million dollars shall be authorized from DOD funds for the installation of 360 degree radar systems on Coast Guard long range surveillance aircraft.

Section 3057—Additional Department of Defense Drug Law Enforcement Assistance.—Within 90 days after the enactment of this Act, the Secretary of Defense shall submit to Congress a detailed list of all forms of assistance that shall be made available by DOD to civilian drug law enforcement and drug interdiction agencies, and a detailed plan for promptly lending equipment and rendering interdiction related assistance to such agencies.

The list shall include:

- surveillance equipment;
- communications equipment, including secure communications;
- support available from the reserve components of the armed forces;
- intelligence on growing, processing, and transshipment of drugs;
- support from the Southern Command and other commands available to assist in interdiction;
- aircraft suitable for use in air-to-air detection, interception, tracking, and seizure;
- marine vessels suitable for use in maritime detection, interception, tracking, and seizure; and
- land vehicles appropriate for interdiction operations.

The House and Senate Committees on Armed Services shall submit their approval or disapproval of such a list to the Secretary of Defense within 30 days after receiving it. Upon receipt of approval or disapproval, the Secretary shall immediately convene a conference of the heads of Federal drug law enforcement agencies to determine appropriate distribution of assets and assistance. Not later than 60 days after the convening of this conference, the Secretary and heads of the agencies shall enter into appropriate memoranda of agreement specifying such distribution.

Compliance with this section is to be monitored by the Comptroller General, who shall transmit to Congress a report containing his/her findings, including a review of memoranda of agreement, no later than 90 days after the convening of the conference described above.

Subtitle B—Customs Enforcement

Section 3141—Authorization of Appropriations for Fiscal Year 1987 for the United States Customs Service. —An appropriation of $1,001,180,000 is authorized for Customs salaries and expenses for Fiscal Year 1987:

- $749,131,000 for salaries and expenses to maintain current operating levels, including sums necessary to complete testing of and implement the automatic license plate reader program;
- $80,999,000 for salaries and expenses of additional personnel to be used in carrying out drug enforcement activities; and
- $171,050,000 for the air interdiction program.

Of the sum for the air interdiction program:

- $93.5 million is for additional aircraft, communications enhancements, and C^3I centers; and
- $350,000 is for a feasibility and application study for a low-level radar detection system in collaboration with the Los Alamos National Laboratory.

Subtitle D—Coast Guard

Section 3251—Coast Guard Drug Interdiction Enhancement. —Eighty-nine million dollars is authorized to be appropriated to the Coast Guard for acquisition, construction, and improvements.

Thirty-nine million dollars is authorized to be appropriated for operating expenses. This amount shall be used to increase the Fiscal Year 1987 full-time equivalent strength level for active duty personnel to 39,220, and to increase the utilization rate of Coast Guard equipment.

Subtitle E—United State-Bahamas Drug Interdiction Task Force

Section 3301—Establishment of a United States-Bahamas Drug Interdiction Task Force.—The Secretary of State, Coast Guard Commandant, Attorney General, and head of NNBIS shall immediately commence negotiations with the Government of the Bahamas to enter into a detailed agreement for the establishment and operation of a drug interdiction task force. The Attorney General shall report quarterly to appropriate Congressional committees on the progress of this Task Force. $10 million is authorized to be appropriated: $9 million for 3 pursuit helicopters and $1 million for communications.

Five million dollars is authorized to be appropriated to the Coast Guard for Fiscal Year 87 for initial design engineering and other activities for the construction of a drug interdiction docking facility in the Bahamas to facilitate Coast Guard and Bahamian drug interdiction operations in and through the Bahama Islands.

Subtitle F—Command, Control, Communications, and Intelligence Centers

Section 3351—Establishment of Command, Control, Communications, and Intelligence Centers (C^3I).— Twenty-five million dollars is authorized to be appropriated to Customs for the establishment of C^3I centers, including sector operations centers and a national C^3I center. The coordination of the establishment and location of these centers is to be conducted by the Commissioner of Customs together with the Commandant of the Coast Guard, the Attorney General, and NNBIS.

Subtitle H—Department of Justice Funds for Interdiction Operations in Hawaii

Section 3421—Additional Funds for the Department of Justice. —Seven million dollars is authorized to be appropriated to the Department of Justice for Fiscal Year 1987 for helicopters with FLIR devices for drug interdiction operations in Hawaii.

Title VII—National Antidrug Reorganization and Coordination

Section 7003—Submission of Legislation

Not later than 6 months after the enactment of this title, the President shall submit to each House of Congress recommendations for legislation to reorganize the Executive Branch to more effectively combat drug traffic and abuse. In preparation of such recommendations, the President shall consult with the Comptroller General, State and local law enforcement authorities, relevant committees of Congress, the Attorney General, and the Secretaries of State, Treasury, Transportation, Health and Human Services, Defense, and Education.

APPENDIX B
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