HISTORY OF THE NIGERIAN PETROLEUM INDUSTRY

Oil was discovered in Nigeria in 1956 at Oloibiri in the Niger Delta after half a century of exploration. The discovery was made by Shell-BP, at the time the sole concessionaire. Nigeria joined the ranks of oil producers in 1958 when its first oil field came on stream producing 5,100 bpd. After 1960, exploration rights in onshore and offshore areas adjoining the Niger Delta were extended to other foreign companies. In 1965 the EA field was discovered by Shell in shallow water southeast of Warri.

In 1970, the end of the Biafran war coincided with the rise in the world oil price, and Nigeria was able to reap instant riches from its oil production. Nigeria joined the Organisation of Petroleum Exporting Countries (OPEC) in 1971 and established the Nigerian National Petroleum Company (NNPC) in 1977, a state owned and controlled company which is a major player in both the upstream and downstream sectors.

Following the discovery of crude oil by Shell D'Arcy Petroleum, pioneer production began in 1958 from the company's oil field in Oloibiri in the Eastern Niger Delta. By the late sixties and early seventies, Nigeria had attained a production level of over 2 million barrels of crude oil a day. Although production figures dropped in the eighties due to economic slump, 2004 saw a total rejuvenation of oil production to a record level of 2.5 million barrels per day. Current development strategies are aimed at increasing production to 4 million barrels per day by the year 2010.

Petroleum production and export play a dominant role in Nigeria's economy and account for about 90% of her gross earnings. This dominant role has pushed agriculture, the traditional mainstay of the economy, from the early fifties and sixties, to the background.

Major Events in the history of the Nigerian Oil and Gas
1908
Nigerian Bitumen Co. & British Colonial Petroleum commenced operations around Okitipupa.

1938
Shell D' Arcy granted Exploration license to prospect for oil throughout Nigeria.

1955
Mobil Oil Corporation started operations in Nigeria.

1956
First successful well drilled at Oloibiri by Shell D'Arcy

1956
Changed name to Shell-BP Petroleum Development Company of Nigeria Limited.

1958
First shipment of oil from Nigeria.

1961
Shell's Bonny Terminal was commissioned.
Texaco Overseas started operations in Nigeria.

1962
Elf started operations in Nigeria. (As Safrap)
Nigeria Agip Oil Company started operations in Nigeria

1963
Elf discovered Obagi field and Ubata gas field
Gulf’s first production

1965
Agip found its first oil at Ebocha
Phillips Oil Company started operations in Bendel State
1966
Elf started production in Rivers State with 12,000 b/d

1967
Phillips drilled its first well (Dry) at Osari –I
Phillips first oil discovery at Gilli-Gilli -I

1968
Mobil Producing Nigeria Limited) was formed.
Gulf’s Terminal at Escravos was commissioned

1970
Mobil started production from 4 wells at Idoho Field
Agip started production
Department of Petroleum Resources Inspectorate started.

1971
Shell's Forcados Terminal Commissioned
Mobil's terminal at Qua Iboe commissioned

1973
First Participation Agreement; Federal Government acquires 35% shares in the Oil Companies
Ashland started PSC with then NNOC (NNPC)
Pan Ocean Corporation drilled its first discovery well at Ogharefe –I

1974
Second Participation Agreement, Federal Government increases equity to 55%.
Elf formally changed its name from "Safrap"
Ashland's first oil discovery at Ossu –I

1975
First Oil lifting from Brass Terminal by Agip
DPR upgraded to Ministry of Petroleum Resources
1976
MPE renamed Ministry of Petroleum Resources (MPR)
Pan Ocean commenced production via Shell-BP’s pipeline at a rate of 10,800 b/d

1977
Government established Nigerian National Petroleum Corporation (NNPC) by Decree 33, (NNOC & MPR extinguished).

1979
Third Participation Agreement (throughout NNPC) increases equity to 60%
Fourth Participation Agreement; BP’s shareholding nationalised, leaving NNPC with 80% equity and Shell 20% in the joint Venture.
Changed name to Shell Petroleum Development Company of Nigeria (SPDC)

1984
Agreement consolidating NNPC/Shel1 joint Venture.

1986
Signing of Memorandum of Understanding (MOU)

1989
Fifth Participation Agreement; (NNPC=60%, Shell = 30%, Elf=5%, Agip=5%).

1991
Signing of Memorandum of Understanding & joint Venture Operating Agreement (JOA)

1993
Production Sharing Contracts signed -SNEPCO
Sixth Participation Agreement; (NNPC=55%, Shell=30%, Elf= 10%, Agip=5%).
The coming on-stream of Elf’s Odudu blend, offshore OML 100.
1995
SNEPCO starts drilling first Exploration well.
NLNG's Final Investment Decision taken

1999
NLNG's First shipment of Gas out of Bonny Terminal.

2000
NPDC/NAOC Service Contract signed

2001
Production of Okono offshore field.

2002
New PSCs agreement signed.
Liberalisation of the downstream oil sector.
NNPC commences retail outlet scheme

NIGERIAN CONTENT DEVELOPMENT IN THE OIL AND GAS SECTOR

WHAT IS NIGERIAN CONTENT?

Nigerian Content is defined as the quantum of composite value added or created in the Nigerian economy through the utilisation of Nigerian human and material resources for the provision of goods and services to the petroleum industry within acceptable quality, health, safety and environmental standards in order to stimulate the development of indigenous capabilities.

WHAT ARE GOVERNMENT TARGETS FOR NIGERIAN CONTENT ?

The targets set by the Federal Government for Nigerian content is 45% by 2006 and 70% by 2010
WHAT IS NNPC'S VISION FOR NIGERIAN CONTENT?

Our "Nigerian Content" vision is to transform the oil and gas industry into the economic engine for job creation and national growth by developing in-country capacity and indigenous capabilities. In this way, greater proportion of the work will be done in Nigeria with active participation of all sectors of the economy and ultimately Nigeria will be positioned as the hub for service delivery within the West African sub region and beyond.

WHAT IS THE MAIN THRUST OF THE NIGERIAN CONTENT POLICY?

Promote a framework that guarantees active participation of Nigerians in Oil and Gas activities without compromising standards in order to stimulate growth of indigenous capacity.
Promote Value Adding in Nigeria by Utilisation of local raw materials and human resources for manufacturing of Goods and provision of services to the Petroleum industry.
Promote steady measurable and sustainable growth of Nigerian Content.

WHAT FRAMEWORK IS IN PLACE?

A national vision and action plan included in a Policy Package.

Based on contributions by stakeholders and key players in the industry at numerous workshops and seminars, a Nigerian Content Policy has been submitted to the Government.

A legal device in the form of an Act, Statute or Regulation to give it normative force.
A draft Nigerian Content Development Bill has been submitted by NNPC to Government. The Regulation which is the responsibility of DPR will be ready once the bill is enacted.
An organizational framework which sees to the implementation of the Policy. A Nigerian Content Division, headed by a Group General Manager was set up in March 2005 under the GMD's office. The division is sufficiently empowered to work with industry stakeholders and relevant arms of government to develop strategies, drive implementation and ensure compliance with directives being issued to the Oil companies regarding the Nigerian Content aspirations of Government.

A Nigerian Content Consultative Forum (NCCF) was also inaugurated with 8 Sectorial Working Committees covering Fabrication, Engineering, Manufacturing, Banking & Insurance, Shipping & Marine, Well & Drilling as well as Logistics services.

Another key feature of the organizational framework is the introduction of a Joint Qualification System (JQS) into the contracting process to provide a data bank of available Contractors and Suppliers of goods and services to the Nigerian Petroleum Industry and streamline the prequalification process. The JQS which will be launched in the third quarter of 2005 will eliminate subjectivity and open up genuine opportunities for participation of qualified Nigerian contractors.

**WHAT INTERVENTIONS TO MEET TARGETS OF 45% BY 2006 AND 70% BY 2010 SET BY GOVERNMENT?**

NCD is gathering data and developing interventions in consultation with Sectorial committees of the NCCF keyed to the achievement of government targets. To this end, the first set of specific intervention guidelines have been issued to all Operators and NNPC departments responsible for projects and operations in the upstream, midstream and downstream sectors on the scope of work that must be performed in Nigeria to achieve set targets.

The notable guidelines are as follows;
FEED and Detailed Engineering for all projects are to be domiciled in Nigeria by end 2005;
Henceforth, all fixed platforms (Offshore and Onshore) piles, anchors, buoys, jackets, bridges, flare booms, storage tanks including selected process equipment and pressure vessels are to be fabricated in Nigeria to maximize utilisation of local fabrication yards;
All FPSO Contract packages are to be bid on the basis of carrying out integration within the country starting from Mid 2006;
Domestication of all seismic data processing and reservoir management studies effective end of 2005;
Clauses that create impediments for/exclude participation of local companies should not be included in any Invitation to Tender (ITT) documents.
Harmonize and apply international codes and standards that support utilisation of locally manufactured products such as paints, cables, etc to improve capacity utilisation in local industries by 2nd Qtr 2005;

HOW ARE THE OIL COMPANIES RESPONDING TO THE NIGERIAN CONTENT INTERVENTIONS?

The Oil companies are already NNPC partners in several Joint Ventures and PSC arrangements for E&P investments in the industry. Expectedly, we have received support from the oil companies who have participated in the review of the draft Nigerian Content Bill, JQS and Capacity Development programs. The oil companies also belong to the NCCF which meets monthly and have complied with several requirements of the NCD. Nigerian Content Managers have been designated in the Oil companies in line with the coordination procedure.

WILL THE NIGERIAN CONTENT POLICY STRAIN THE RELATIONSHIP BETWEEN NNPC AND MULTINATIONAL OIL COMPANIES?

No. Most multinational companies that do business in Nigeria have had experience in Local content development in their home countries and other locations where
they operate. To ensure a smooth transition, NNPC has consulted widely and adapted tested and sustainable strategies from other countries in similar setting.

**HOW WILL NIGERIAN CONTENT DEAL WITH EXPATRIATE QUOTA IN THE OIL AND GAS SECTOR?**

The Nigerian Content Bill makes provisions that empower DPR to participate in the processing of expatriate quotas for cases involving the Oil and Gas industry. Also the requirement for professional bodies to certify foreign professionals who want to practice in Nigeria is another way to ensure that only unavailable expertise is imported. Professional bodies have been approached to work out modalities.

**ARE THERE SANCTIONS FOR NON-COMPLIANCE WITH NIGERIAN CONTENT PROVISIONS?**

The draft bill makes provision for sanctions and penalties to be applied to defaulting participants. The coordination procedure also provides checks and monitoring points to ensure compliance proactively.

**WHAT ARE THE KEY EXPECTATIONS FROM NIGERIAN CONTENT INITIATIVES?**

In the short term, the intervention guidelines are expected to create several thousand jobs for Engineer, welders and other professionals and artisans in the Engineering, Procurement and Construction phase of the project.

With requirements for utilization of locally manufactured goods and equipment, major investments in infrastructure are expected and the local manufacturing industry will be reinvigorated.

**WHICH SECTORS ARE COVERED BY NIGERIAN CONTENT POLICY?**
The policy applies to all sectors of the Nigerian Oil and Gas industry. In this phase of activities, primary focus is placed on major contracts and operations in Upstream, (JV, PSC & Indigenous Producers) Midstream (Gas & Power Projects) and Downstream (Refinery, Petrochemicals and other) sectors.

The plan is to progress this initiative to the extent that other segments of the national economy begin to benefit from the capacity in the oil and gas sector.

**WHAT ARE THE RECENT ACHIEVEMENTS THROUGH NIGERIAN CONTENT?**

A lot is going on in the Nigerian Content scheme. Apart from the organization of many Nigerian companies to brace for the several opportunities from the recent guidelines, actual progress has been recorded in quantum of work awarded to Nigerian Contractors. Oil companies have realigned their work plans to reflect the aspirations of the policy. Nigerian Content Division is ensuring that any work that can be executed in Nigeria or by Nigerians is specified in the Nigerian content scope in ITTs before they are issued.

**HOW DO YOU PLAN TO BUILD REQUIRED CAPACITY FOR NIGERIAN COMPANIES IN THE INDUSTRY?**

Capacity building is one of the key planks for achieving government targets and this is pursued in the following activities;

Survey of available capacity and identification of needs for new projects and operations;
Identify new Opportunities for Local suppliers;
Training of Nigerians in targeted areas of competency and acquisition of Technological and Managerial capability;
Development of infrastructure and upgrade of facilities
Local Business and supplier enhancement;
Project Financing and funding of local businesses
**OPEC's mission** is to coordinate and unify the petroleum policies of Member Countries and ensure the stabilization of oil markets in order to secure an efficient, economic and regular supply of petroleum to consumers, a steady income to producers and a fair return on capital to those investing in the petroleum industry.

**Brief history** The Organization of the Petroleum Exporting Countries (OPEC) is a permanent intergovernmental organization, created at the Baghdad Conference on September 10–14, 1960, by Iran, Iraq, Kuwait, Saudi Arabia and Venezuela. The five Founding Members were later joined by nine other Members: Qatar (1961); Indonesia (1962); Socialist Peoples Libyan Arab Jamahiriya (1962); United Arab Emirates (1967); Algeria (1969); Nigeria (1971); Ecuador (1973) -- suspended its membership from December 1992-December 2007; Angola (2007); and Gabon (1975–1994).

The Organization of the Petroleum Exporting Countries (OPEC) is a permanent, intergovernmental Organization, created at the Baghdad Conference on September 10–14, 1960, by Iran, Iraq, Kuwait, Saudi Arabia and Venezuela. The five Founding Members were later joined by nine other Members: Qatar (1961); Indonesia (1962); Socialist Peoples Libyan Arab Jamahiriya (1962); United Arab Emirates (1967); Algeria (1969); Nigeria (1971); Ecuador (1973) – suspended its membership from December 1992-December 2007; Angola (2007) and Gabon (1975–1994). OPEC had its headquarters in Geneva, Switzerland, in the first five years of its existence. This was moved to Vienna, Austria, on September 1, 1965.

OPEC's objective is to co-ordinate and unify petroleum policies among Member Countries, in order to secure fair and stable prices for petroleum producers; an efficient, economic and regular supply of petroleum to consuming nations; and a fair return on capital to those investing in the industry.
The 1960s

These were OPEC’s formative years, with the Organization, which had started life as a group of five oil-producing, developing countries, seeking to assert its Member Countries’ legitimate rights in an international oil market dominated by the ‘Seven Sisters’ multinational companies. Activities were generally of a low-profile nature, as OPEC set out its objectives, established its Secretariat, which moved from Geneva to Vienna in 1965, adopted resolutions and engaged in negotiations with the companies. Membership grew to ten during the decade.

The 1970s

OPEC rose to international prominence during this decade, as its Member Countries took control of their domestic petroleum industries and acquired a major say in the pricing of crude oil on world markets. There were two oil pricing crises, triggered by the Arab oil embargo in 1973 and the outbreak of the Iranian Revolution in 1979, but fed by fundamental imbalances in the market; both resulted in oil prices rising steeply. The first Summit of OPEC Sovereigns and Heads of State was held in Algiers in March 1975. OPEC acquired its 11th and final current Member, Nigeria, in 1971.

The 1980s

Prices peaked at the beginning of the decade, before beginning a dramatic decline, which culminated in a collapse in 1986 — the third oil pricing crisis. Prices rallied in the final years of the decade, without approaching the high levels of the early-1980s, as awareness grew of the need for joint action among oil producers if market stability with reasonable prices was to be achieved in the future. Environmental issues began to appear on the international agenda.

The 1990s

A fourth pricing crisis was averted at the beginning of the decade, on the outbreak of hostilities in the Middle East, when a sudden steep rise in prices on panic-
stricken markets was moderated by output increases from OPEC Members. Prices then remained relatively stable until 1998, when there was a collapse, in the wake of the economic downturn in South-East Asia. Collective action by OPEC and some leading non-OPEC producers brought about a recovery. As the decade ended, there was a spate of mega-mergers among the major international oil companies in an industry that was experiencing major technological advances. For most of the 1990s, the ongoing international climate change negotiations threatened heavy decreases in future oil d

**OPEC’S FUNCTION**

The OPEC Member Countries coordinate their oil production policies in order to help stabilise the oil market and to help oil producers achieve a reasonable rate of return on their investments. This policy is also designed to ensure that oil consumers continue to receive stable supplies of oil.

The Ministers of energy and hydrocarbon affairs meet twice a year to review the status of the international oil market and the forecasts for the future in order to agree upon appropriate actions which will promote stability in the oil market.

The Member Countries also hold other meetings at various levels of interest, including meetings of petroleum and economic experts, country representatives and special purpose bodies such as committees to address environmental affairs.

Decisions about matching oil production to expected demand are taken at the Meeting of the OPEC Conference. Details of such decisions are communicated in the form of OPEC Press Releases.

The OPEC Secretariat is a permanent inter-governmental body. The Secretariat which has been based in Vienna since 1965, provides research and administrative support to the MCs. The Secretariat also disseminates news and information to the World at large.

The official language of the Secretariat is English.
Frequently asked questions about OPEC

What is OPEC?

The organization of the Petroleum Exporting Countries (OPEC) is a permanent intergovernmental organization, currently made up of 13 oil producing and exporting countries, spread across three continents America, Asia and Africa. The members are Algeria, Angola, Ecuador, Indonesia, the Islamic Republic of Iran, Iraq, Kuwait, the Socialist People’s Libyan Arab Jamahiriya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates & Venezuela.

These countries have a total population of about 585 million and for nearly all of them, oil is the main marketable commodity and foreign exchange earner. Thus, for these countries, oil is the vital key to development – economic, social and political. Their oil revenues are used not only to expand their economic and industrial base, but also to provide their people with jobs, education, health care and a decent standard of living.

The organization’s principal objectives are:

1. To co-ordinate and unify the petroleum policies of the Member Countries and to determine the best means for safeguarding their individual and collective interests;

2. To seek ways and means of ensuring the stabilization of prices in international oil markets, with a view to eliminating harmful and unnecessary fluctuations; and

3. To provide an efficient economic and regular supply of petroleum to consuming nations and a fair return on capital to those investing in the petroleum industry.

WHEN WAS OPEC FORMED?

OPEC was formed at a meeting held on September 14, 1960 in Baghdad, Iraq, by five Founder Members: Iran, Iraq, Kuwait, Saudi Arabia and Venezuela. OPEC was
registered with the United Nations Secretariat on November 6, 1962 (UN Resolution No 6363).

Who are OPEC Member Countries?

The OPEC Statute stipulates that: "any country with a substantial net export of crude petroleum, which has fundamentally similar interests to those of Member Countries, may become a Full Member of the Organization, if accepted by a majority of three-fourths of Full Members, including the concurring votes of all Founder Members".

The Statute further distinguishes between three categories of membership: Founder Member, Full Member and Associate Member.

**Founder Members** of the Organization are those countries which were represented at OPEC's first Conference, held in Baghdad, Iraq, in September 1960, and which signed the original agreement establishing OPEC.

**Full Members** are the Founder Members, plus those countries whose applications for Membership have been accepted by the Conference.

**Associate Members** are the countries which do not qualify for full membership, but which are nevertheless admitted under such special conditions as may be prescribed by the Conference.

<table>
<thead>
<tr>
<th>Country</th>
<th>Joined OPEC</th>
<th>Location</th>
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<tbody>
<tr>
<td>Algeria</td>
<td>1969</td>
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<tr>
<td>Angola</td>
<td>2007</td>
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<tr>
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<td>rejoined 2007</td>
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<td>Indonesia</td>
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<td>IR Iran*</td>
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<td>Nigeria</td>
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</tr>
<tr>
<td>Venezuela*</td>
<td>1960</td>
<td>South America</td>
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*Founder Members


**How does OPEC function?**

Representatives of OPEC Member Countries (Heads of Delegation) meet at the OPEC Conference to co-ordinate and unify their petroleum policies in order to promote stability and harmony in the oil market. They are supported in this by the OPEC Secretariat, directed by the Board of Governors and run by the Secretary General, and by various bodies including the Economic Commission and the Ministerial Monitoring Committee.

The Member Countries consider the current situation and forecasts of market fundamentals, such as economic growth rates and petroleum demand and supply scenarios. They then consider what, if any, changes they might make in their petroleum policies. For example, in previous Conferences the Member Countries have decided variously to raise or lower their collective oil production in order to maintain stable prices and steady supplies to consumers in the short, medium and longer term.

**What is the OPEC Conference?**
The Conference is the supreme authority of the Organization, and consists of
delegations normally headed by the Ministers of Oil, Mines and Energy of Member
Countries.

The Conference generally meets twice a year, in March and September, and in
extraordinary sessions whenever required. It operates on the principle of
unanimity and one Member, one vote. It is responsible for the formulation of the
general policy of the Organization and the determination of the appropriate ways
and means of its implementation.

The Conference also decides upon applications for membership of the
Organization, and on reports and recommendations submitted by the Board of
Governors on the affairs of the Organization. It approves the appointment of
Governors from each Member Country and elects the Chairman of the Board.

Moreover, the Conference directs the Board to submit reports or make
recommendations on any matter of interest to the Organization, and considers and
decides upon the Organization’s budget, as submitted to it by the Board.

Who are the heads of Delegation?

The Heads of Delegation to OPEC are the official representatives of each Member
Country to the OPEC Conference. They are normally the Ministers of Oil, Mines and
Energy of Member Countries.

What is the Board of Governors?

The Board of Governors, or BoG, can be compared to the board of directors of a
commercial organization. The BoG is composed of Governors nominated by
Member Countries and confirmed by the Conference for two years. The Board
directs the management of the Organization; implements Resolutions of the
Conference; draws up the Organization’s annual budget and submits it to the
Conference for approval. It also decides upon any reports submitted by the
Secretary General and submits reports and recommendations to the Conference on the affairs of the Organization.

The role of the Board of Governors is described in Article 20 of the OPEC Statute (below).

**The Board of Governors shall:**

1. Direct the management of the affairs of the Organization and the implementation of the decisions of the Conference;

2. Consider and decide upon any reports submitted by the Secretary General;

3. Submit reports and make recommendations to the Conference on the affairs of the Organization;

4. Draw up the Budget of the Organization for each calendar year and submit it to the Conference for approval;

5. Nominate the Auditor of the Organization for a duration of one year;

6. Consider the Statement of Accounts and the Auditor's Report and submit them to the Conference for approval;

7. Approve the appointment of Directors of Divisions and Heads of Departments, upon nomination by Member Countries, due consideration being given to the recommendations of the Secretary General;

8. Convene an Extraordinary Meeting of the Conference; and

9. Prepare the Agenda for the Conference.

**What is the Economic Commission?**

The Economic Commission is a specialized body operating within the framework of the Secretariat, with a view to assisting the Organization in promoting stability
in the international oil market. The Commission is composed of a Commission Board, National Representatives, and a Commission staff. The Commission Board consists of the Secretary General, the National Representatives appointed by the Member Countries, and a Commission Co-ordinator (who is ex-officio the Director of the Research Division).

What is the Ministerial Monitoring Sub-Committee?

The Ministerial Monitoring Sub-Committee (MMSC) was established in February 1993 by the 10th Meeting of the Ministerial Monitoring Committee in order to monitor oil production and exports by Member Countries. The MMSC comprises three Heads of Delegation and the Secretary General.

What is the OPEC Secretariat?

The OPEC Secretariat functions as the Headquarters of OPEC. It is responsible for carrying out the executive functions of the Organization, in accordance with the provisions of the Statute and under the direction of the Board of Governors.

The Secretariat consists of the Secretary General, and the Research Division headed by the Director of Research, and comprising the Petroleum Market Analysis, Energy Studies and Data Services Departments. Other functions include the PR & Information Department, the Administration & Human Resources Department, and the Office of the Secretary General.

The Secretariat was originally established in Geneva, Switzerland, in 1961 but it was moved to Vienna, Austria, in 1965. The 8th (Extraordinary) OPEC Conference approved the Host Agreement with the Austrian Government in April 1965, prior to the opening of the OPEC Secretariat in Vienna on September 1, 1965.

Why does OPEC set oil production quotas?

The OPEC Statute requires OPEC to pursue stability and harmony in the petroleum market for the benefit of both oil producers and consumers. To this end, OPEC
Member Countries respond to market fundamentals and forecast developments by co-ordinating their petroleum policies. Production regulations are simply one possible response. If demand grows, or some oil producers are producing less oil, OPEC can increase its oil production in order to prevent a sudden rise in prices. OPEC might also reduce its oil production in response to market conditions.

**Does OPEC control the oil market?**

No, OPEC does not control the oil market. OPEC Member Countries produce about 45 per cent of the world's crude oil and 18 per cent of its natural gas. However, OPEC's oil exports represent about 55 per cent of the crude oil traded internationally. Therefore, OPEC can have a strong influence on the oil market, especially if it decides to reduce or increase its level of production.

OPEC seeks stability in the oil market and endeavours to deliver steady supplies of oil to consumers at fair and reasonable prices. The Organization has achieved this in a number of ways: sometimes by voluntarily producing less oil, sometimes by producing more when there is a shortfall in supplies (such as during the Gulf Crisis in 1990, when several million barrels of oil per day were suddenly removed from the market).

**Does OPEC Set Crude Oil Prices?**

One of the most common misconceptions about OPEC is that the Organization is responsible for setting crude oil prices. Although OPEC did in fact set crude oil prices from the early 1970s to the mid-1980s, this is no longer the case. It is true that OPEC's Member Countries do voluntary restrain their crude oil production in order to stabilize the oil market and avoid harmful and unnecessary price fluctuations, but this is not the same thing as setting prices.

In today's complex global markets, the price of crude oil is set by movements on the three major international petroleum exchanges, all of which have their own Web sites featuring information about oil prices. They are the New York

The Web sites of the Paris-based International Energy Agency (IEA, http://www.iea.org) and the US Energy Information Administration (EIA, http://www.eia.doe.gov), also have extensive historical information on oil prices.

How does OPEC oil production affect oil prices?

The Oil and Energy Ministers of the OPEC Member Countries meet at least twice a year to co-ordinate their oil production policies in light of the market fundamentals, ie, the likely future balance between supply and demand.

The Member Countries, represented by their respective Heads of Delegation, may or may not alter production levels during the Meetings of the OPEC Conference.

Given that OPEC Countries produce about 45 per cent of the world's crude oil and about 55 per cent of the oil traded internationally, any decisions to increase or reduce production may lower or raise the price of crude oil.

The impact of OPEC output decisions on crude oil prices should be considered separately from the issue of changes in the prices of oil products, such as gasoline or heating oil. There are many factors that influence the prices paid by end consumers for oil products. In some countries taxes comprise over 70 per cent of the final gasoline price paid by consumers, so even a major change in the price of crude oil might have only a minor impact on consumer prices.

What are OPEC's proven oil reserves?

At the end of 2006, OPEC had proven oil reserves of 927,146 million barrels of crude oil, representing 77.6 per cent of the world total of 1,195,318 million barrels.

What is OPEC's attitude towards fuel-efficient cars?
OPEC is happy to see improvements in transportation technology to make it cleaner, safer and more efficient.

The organization would prefer that more people enjoy the benefits of personal mobility in an environmentally sustainable manner.

Oil is a precious, limited resource and we want people to value it accordingly.

**Does OPEC support environmental policies?**

OPEC supports sound environmental policies that are fair and equitable, based on proven needs and designed to address those needs.

OPEC is concerned about the environment and we want to ensure that it is clean and healthy for future generations.

OPEC also supports sustainable economic development, which requires steady supplies of energy at reasonable prices. Many countries have already introduced heavy taxes on oil products. In some countries, the price that motorists pay for gasoline is three or four times higher than the price of the original crude oil. Taxes account for up to 70 per cent of the final price of oil products in some countries.

As a result of these taxes, some of the oil-consuming countries (especially those in Europe where taxation levels are highest) receive much more income from oil than OPEC does.

OPEC is concerned that many of the so-called 'green' taxes that are currently levied on oil do not specifically help the environment. Instead, they simply go into government budgets to be spent on other things. Taxes might lead to instability in the oil industry, creating problems for many countries and industries.

Industrialised countries are developing policies to limit the use of fossil fuels in order to reduce their emissions of carbon dioxide. Many are already levying heavy taxes, particularly on oil products. Yet studies have shown that OECD members
could cut their carbon dioxide emissions by 12 per cent by 2010 and still maintain their tax revenues, if they adopted a pro rata tax system that levies tax on all forms of energy according to their carbon content.

OPEC is concerned that some countries may impose environmental and taxation policies that are harmful to those who rely on fossil fuels for a substantial part of their income.

Some countries with high oil taxes actually subsidise domestic coal production, yet coal produces more carbon dioxide than oil. Carbon dioxide is one of the greenhouse gases which are believed to contribute to global warming.

OPEC is worried about discriminatory oil taxes because we are committed to providing a stable petroleum market.

We need to invest in oil exploration and development in order to have production capacity available as demand rises in the years ahead, but we also need to be sure that there will be enough demand for that oil and that we will get a reasonable price.

If we do not invest in expanding oil production capacity before it is needed, the world could face sudden price shocks, leading to serious global economic problems.

OPEC is also concerned that many of the environmental policies now being proposed and adopted do not have the full support of the scientific community. There is still considerable debate about the impact of global warming, and how it can best be addressed. OPEC supports further research into these important issues.

OPEC is also spending heavily to improve its environmental impact, by locating sources of higher quality oil and gas, by developing cleaner fuels for consumers, and by reducing the impact of its activities through safer, cleaner drilling, transportation and refining processes.
OPEC also participates in many international meetings in order to remind governments and others who are debating environmental policies that they must consider the needs of developing countries, especially those that rely on their income from oil.

**Can OPEC guarantee the security of oil supplies?**

Yes, at the right conditions, OPEC can provide an increasing amount of oil to meet the expected growth of global oil demand. OPEC currently produces about 45 per cent of the world's crude oil, but that is forecast to grow to more than 50 per cent in the next quarter of a century.

OPEC has a policy of maintaining stability in the oil market, and its Member Countries have often done this by increasing or decreasing the amount of oil they produce. Only OPEC nations have a significant spare oil production capacity, and this enables them to increase production at relatively short notice. However, because OPEC is not the only source of oil in the market, it cannot guarantee the movement of oil prices, or the availability of supplies to all consumers at all times.

OPEC has around 78 per cent of the world's oil reserves, and this will enable us to expand oil production to meet the growth in demand. But in order to expand our output, we need to be sure that the oil industry will continue to be profitable. Oil producers invest billions of dollars in exploration and infrastructure (drilling and pumping, pipelines, docks, storage, refining, staff housing, etc) and a new oil field can take 3-10 years to locate and develop.

If oil producers do not invest enough money and do it far enough in advance, then the world could face a shortage of oil supplies in future.

Therefore, OPEC is concerned about issues that undermine the prosperity of the oil industry and thus threaten the security of world oil supplies. One such issue is oil taxation in the consuming countries.
Oil taxes reduce the incomes of oil producers, and limit the funds they have available for maintenance, exploration and production activities.

Oil taxes also limit the growth in oil demand and raise costs for other industries. As a result, oil producers and other investors are unsure of the future development of oil prices and profits, and they might hesitate from making the necessary investments.

Although OPEC does try to maintain stability and invest in a timely manner, our efforts to guarantee the security of oil supplies can be undermined - or supported - by the actions of oil consumers.

**Is there any need for security of oil demand?**

Yes, oil consumers need steady supplies of oil, and oil producers rely on steady demand. If demand changed suddenly it would have a major impact on the profitability of oil producers and the economies of many countries around the world.

Oil production is a long-term affair: the oil industry works 24 hours a day, 365 days a year, excluding maintenance or bad weather and other disruptions. Oil facilities require many millions of dollars of investment, and the investors try to earn a reasonable return on their capital.

A downturn in oil demand could force oil production to slow down or stop. This could physically damage the oil fields, reducing the amount of oil that can be recovered in future. The oil installations could also be damaged. Some facilities, such as those operating in the oceans, are very difficult and expensive to shut down.

When production slows down, oil producers might be forced to lay off staff. Downstream operators, such as gasoline retailers, refiners and transport companies, could also be forced to shed staff.
If oil producers receive lower incomes they must spend less money and import fewer goods from oil consumers. If investors are unsure about the risks and the likely returns from petroleum investments they may not make those investments. If we do not invest enough money, or do it far enough in advance, then the world could face a shortage of oil supplies and a downward spiral in the global economy. However, if oil producers continue to receive reasonable prices and stable demand, they will maintain their production and invest far enough in advance to meet the growth of demand.

Thus the security of oil supplies relies upon the security of oil demand. Oil producers - and oil consumers - need to work together to ensure that the security of oil supply and demand is preserved.

**Frequently asked questions about crude oil**

**What is crude oil?**

Crude oil is a naturally-occurring substance found in certain rock formations in the earth. It is a dark, sticky liquid which, scientifically speaking, is classified as a hydrocarbon. This means, it is a compound containing carbon and hydrogen, with or without non-metallic elements such as oxygen and sulfur. Crude oil is highly flammable and can be burned to create energy. Along with its sister hydrocarbon, natural gas, derivatives from crude oil make an excellent fuel.

**How is crude oil measured?**

Crude oil is measured in barrels. When crude oil first came into large-scale commercial use in the United States in the 19th century, it was stored in wooden barrels. One barrel equals 42 US gallons, or 159 litres. In some cases crude oil is also measured in tons. The number of barrels contained in each ton vary depending on the type and specific gravity of each crude, however the average number considered would be around 7.33 barrels per each ton.

**How much proven crude oil reserves exist in the world?**
World proven crude oil reserves are estimated at more than one trillion barrels, of which OPEC Member Countries hold approximately 78 per cent.

OPEC's Members in 2006 produced around 32.6 million barrels per day of crude oil, or 45.3 per cent of the world total output, which stood at about 72.0 million barrels per day.

**What are the uses of crude oil?**

Burning crude oil itself is of limited use. To extract the maximum value from crude, it first needs to be refined into petroleum products. The best-known of these is gasoline, or petrol. However, there are many other products that can be obtained when a barrel of crude oil is refined. These include liquefied petroleum gas (LPG), naphtha, kerosene, gasoil and fuel oil. Other useful products which are not fuels can also be manufactured by refining crude oil, such as lubricants and asphalt (used in paving roads). A range of sub-items like perfumes and insecticides are also ultimately derived from crude oil.

Furthermore, several of the products listed above which are derived from crude oil, such as naphtha, gasoil, LPG and ethane, can themselves be used as inputs or feedstocks in the production of petrochemicals. There are more than 4,000 different petrochemical products, but those which are considered as basic products include ethylene, propylene, butadiene, benzene, ammonia and methanol. The main groups of petrochemical end-products are plastics, synthetic fibres, synthetic rubbers, detergents and chemical fertilisers.

Considering the vast number of products that are derived from it, crude oil is a very versatile substance. Life as we know it today would be extremely difficult without crude oil and its b

**Frequently asked questions about the petroleum industry**

**How much oil is there in the world?**
At the end of 2006, world proven crude oil reserves stood at 1,195,318 million barrels, of which 927,146 million barrels, or 77.6 per cent, was in OPEC Member Countries

**How long does it take to discover oil and bring it to market?**

There is no standard answer to this question, but as a rule of thumb it can take 3-10 years from the decision to explore, through to discovery, testing, development and the delivery of oil from a new field.

The time required depends on where the oil is and thus how difficult it is to discover, test and develop.

For instance, an offshore oil field in deep water can take much longer to discover and test, due to the challenging technical requirements. Drilling in deep water is also difficult and can be very expensive, so the explorers need time to raise the necessary money as well as meet the new technical challenges.

**Will we ever see a repeat of the 1970s oil crisis?**

No. The 1970s oil crisis was a complex affair reflecting issues particular to that time and it is unlikely to be repeated.

Indeed, we all learned a lot from that experience. We know that if oil prices go too high or too low it will be harmful both to oil producers and oil consumers, both in the short- and long-term.

OPEC is dedicated to providing a stable oil market, with reasonable prices and steady supplies to consumers.

Consider the example of the Gulf Crisis in 1990, when production of several million barrels per day of oil from Iraq and Kuwait was suddenly halted, leading to a rapid rise in world oil prices. Those Member Countries not involved decided to increase their oil supplies in order to make up for the shortfall. As a result, oil prices
stabilised and came down again to reasonable levels. However, there is always potential for instability in the oil market.

OPEC continues to seek co-operation among all oil producers and consumers. Such co-operation is necessary to ensure stability.

**What causes low oil prices?**

Low prices of crude oil can be caused by a number of factors. Basically, it could be due to an imbalance between supply and demand - too much supply or too little demand.

OPEC Member Countries have always tried to adjust their crude oil supplies to improve the balance between supply and demand. OPEC's aim at all times is to maintain steady supplies of oil to consumers, while securing a reasonable return for its Member Countries. However, OPEC cannot be expected to achieve this on its own.

Most non-OPEC oil producers supply as much oil as they can. This makes it difficult for OPEC to maintain stability in the oil market and results in losing market share and potential revenue for the organization.

If oil production rises faster than demand, then prices can fall and all oil producers will suffer. In the long run, consumers will also suffer if the oil industry is unprofitable and unattractive to investors.

**What causes high oil prices?**

High crude oil prices could be due to a shortage of oil supplies. High prices for oil products - as purchased by end consumers such as motorists - are more likely to reflect other factors, such as taxation.

Crude oil prices react to the balance of demand and supply in the short term, and the rate of investment in the longer term. If investment is not made far enough in
advance, oil supplies could be limited in the longer term, thus raising prices. Sentiment is also an important factor: if traders in the oil market believe there will be a shortage of oil supplies, they may raise prices before a shortage actually occurs. Other factors influencing the price of crude oil include accidents, bad weather, increasing demand, halting transport of oil from producers, labour disputes (strikes) as well as other disruptions to production including war and natural disasters.

Crude oil now represents less than a quarter of the price of oil products in many countries. Therefore, taxes have more influence over the price of oil products. When oil taxes are raised, end consumers often mistakenly blame the oil producers, but it is really their own governments that are responsible.

OPEC seeks a stable oil market, without sudden price changes or excessively high or low prices. OPEC regularly meets with other oil producers and with consumers in an effort to improve understanding and trust in the oil industry and to seek policies and measures that do not create unnecessary economic hardship for oil producers or consumers.

**What happens if oil prices go up or down?**

The world lives on oil. Oil is the foundation for the plastics and petrochemical industries. Oil is fundamental to the welfare of the industrialised world and it is a major component of the farming industry.

The price of oil is reflected in most of the things we do. It impacts on the price of transport, the cost of goods and services, and the availability of many products, including food, water and shelter.

If oil prices are too high, then these goods and services become more expensive and economies experience inflation. Alternative forms of energy would also become more cost-competitive, but oil producers would eventually increase their supplies and prices would come back down.
If oil prices are too low, consumers would waste this non-renewable resource, investors would not be attracted to the industry and oil producers would suffer - especially the developing countries that produce oil, such as the OPEC Member Countries. If prices were too low, supplies would eventually fall until there was a price shock - leading back to inflation.

Oil prices that are too high or too low are clearly unhelpful for oil producers, oil consumers and the world at large. That is why OPEC makes quite sure that the market is not under-supplied with oil, forcing prices to go excessively high, and also that the market is not over-supplied so that prices go too low. It also speaks to other oil producers to encourage them to avoid over-supplying the market. It is also why OPEC talks to oil consumers to encourage them to adopt fair and equitable policies that do not discriminate against oil.

We would all suffer without steady supplies of oil at stable, reasonable prices.

How much oil does the world consume each day?

According to the reference case of OPEC's World Energy Model (OWEM), total world oil demand in 2000 is put at 76 million barrels per day. As world economic growth continues, crude oil demand will also rise to 90.6m b/d in 2010 and 103.2m b/d by 2020, according to the OWEM reference case figures

Which countries have the world's largest proven crude reserves?

<table>
<thead>
<tr>
<th>Country</th>
<th>Crude oil reserves (million barrels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Arabia</td>
<td>264,251</td>
</tr>
<tr>
<td>IR Iran</td>
<td>138,400</td>
</tr>
<tr>
<td>Iraq</td>
<td>115,000</td>
</tr>
<tr>
<td>Kuwait</td>
<td>101,500</td>
</tr>
</tbody>
</table>
Which countries produce the most oil?

<table>
<thead>
<tr>
<th>Country</th>
<th>Crude oil production (1,000 b/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>9,358</td>
</tr>
<tr>
<td>Saudi Arabia*</td>
<td>9,208</td>
</tr>
<tr>
<td>USA</td>
<td>5,136</td>
</tr>
<tr>
<td>Iran</td>
<td>4,073</td>
</tr>
<tr>
<td>China</td>
<td>3,674</td>
</tr>
</tbody>
</table>

* Including share of production from Neutral Zone.

Source: OPEC Annual Statistical Bulletin 2006

Do non-OPEC oil producers support market stability?

Historically, most non-OPEC producers have taken advantage of OPEC's voluntary production restraint by increasing their own production whenever possible. As a result, the market share of non-OPEC producers rose for a number of years, but oil prices remained at relatively low levels and the markets were less stable than they could have been.

However, the oil price slump of 1998 and early 1999 reinforced OPEC's constant message that oil market stability can only be achieved through co-operation between OPEC and non-OPEC oil producers. In support of OPEC's efforts to restore
stability to the oil market by restraining output, several non-OPEC oil producers also cut their production, thus helping prices recover from the slump. These countries included Mexico, Norway, Oman, and Russia.

Will oil remain the most important source of energy?

Historically Yes, OPEC believes that oil demand will continue to grow strongly and oil will remain the world's single most important source of energy for the foreseeable future. The OWEM reference case sees oil's share of the world fuel mix falling slightly from over 41 per cent today to just over 39 per cent in 2020. However, oil will still be the world's single largest source of energy. The reduction in oil's market share is largely due to the stronger growth enjoyed by other forms of energy, particularly natural gas (see the table below).

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>2000</th>
<th>2010</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>41.3</td>
<td>41.3</td>
<td>40.3</td>
<td>39.2</td>
</tr>
<tr>
<td>Gas</td>
<td>22.2</td>
<td>22.4</td>
<td>24.1</td>
<td>26.6</td>
</tr>
<tr>
<td>Solids</td>
<td>26.2</td>
<td>26.1</td>
<td>26.3</td>
<td>25.8</td>
</tr>
<tr>
<td>Hydro/Nuclear</td>
<td>10.4</td>
<td>10.3</td>
<td>9.3</td>
<td>8.5</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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</tbody>
</table>

Source: OWEM Scenarios Report, March 2000

Is the world running out of oil?

Oil is a limited resource, so it may eventually run out, although not for many years to come.

At the rate of production in 2006, OPEC's oil reserves are sufficient to last more than 81 years, while non-OPEC oil producers' reserves might last less than 20
years. The worldwide demand for oil is rising and OPEC is expected to be an increasingly important source of that oil.

If we manage our resources well, use oil efficiently and develop new fields, then our oil reserves should last for many more generations to come.

**What impact can OPEC have on industry?**

The economics of industry depends, in part, on its costs, of which a large part is represented by the cost of energy, such as gasoline or fuel oil. The cost of these oil products is affected by the price of crude oil, taxation and other factors.

The price of crude oil is influenced by the decisions taken by all oil producers, particularly the prices for which they are willing to sell and the quantities they are willing and able to supply.

If there is a shortage of oil supplies, then the price of oil will likely rise. This would have all sorts of implications for industry, such as higher transportation costs. Higher costs can lead to lower economic growth, and this will also impact on industry.

The OPEC Statute, written when OPEC was formed 1960, declares that OPEC is dedicated to providing a stable petroleum market, with steady supplies to consumers, reasonable prices and fair returns to investors in the oil industry. In pursuit of these aims, OPEC has for many years maintained a limit on the oil produced by its Member Countries. This has provided for a relatively stable oil industry, with reasonable prices. But OPEC is concerned that factors outside of its control may disrupt this stability. This includes taxation, which now constitutes the largest part of the price of oil products in some countries.

**What investment is required for oil exploration and development?**

Oil exploration can cost tens or hundreds of billions of dollars.

The actual costs depend on such factors as the location of possible oil reserves (i.e. on land or in deep water), how large the oil field is expected to be, how detailed the exploration
information must be, and the type and structure of the rock below the ground. Exploration requires careful mapping of the surface in order to locate suitable sites (ie, types of geological structures), deep formation surveys (eg, with two and three-dimensional seismic techniques), and test-drilling. It is not easy to determine a typical cost of such activities.

OPEC has the lowest average production costs in the oil industry. This is partly because some OPEC Member Countries have large amounts of oil in reasonably accessible locations. Yet OPEC Members will still need to spend tens of billions of dollars in future to meet the growing need for oil.

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Delivered by HE Abdalla Salem El-Badri, OPEC Secretary General, to the high-level segment of the 13th session of the Conference of the Parties to the UN Framework Convention on Climate Change & the 3rd session of the Conference of the Parties acting as the Meeting of the Parties to the Kyoto Protocol

14 December 2007, Bali

, Indonesia

Excellencies, ladies and gentlemen,

Let me begin by expressing my deep appreciation to the Government and people of Indonesia for hosting this Conference on this wonderful island of Bali and for their warm hospitality.
I am delighted to be here today and participate in such an important conference, taking place in an OPEC Member Country and tackling the issue of our time “climate change”, an issue widely covered at the OPEC Summit recently held in Riyadh.

Here in Bali there has been much discussion concerning where the Kyoto Protocol is today, and what the future holds for a post-Kyoto agreement. However, in all these discussions we must move forward by learning from our past experience. The key question in this regard is a simple one: why were we able to reach an agreement for the creation of the Kyoto Protocol.

We reached agreement after years of negotiation because everyone had a stake, but perhaps more importantly, everyone perceived that their issues were recognized and taken on board.

For developing countries in general it was of fundamental importance that the principle of “common, but differentiated responsibilities and respective capabilities” be central to this agreement since developed countries have a historical responsibility to take the lead in combating climate change. Developed countries are largely responsible for the historical build-up of global greenhouse gas emissions and even to this day continue to emit close to half of all emissions despite representing only 20% of the planet’s population.

The Kyoto Protocol is not exempt of shortcomings, but overall it is a good compromise. It envisaged flexibility mechanisms to facilitate the meeting of emission reduction quota commitments by developed country Parties, while promoting cleaner development in countries that do not have specific emission reduction quotas.

Over the years we have witnessed how many voluntary initiatives from the developing world have been launched with climate change in mind. Most recently a number of OPEC Member Countries namely Saudi Arabia with $300 million and Kuwait, Qatar and the
United Arab Emirates each with $150 million have created a fund aimed at investing in technological solutions to protect the environment.

For developed countries, however, many are still far from meeting their commitments to reduce their overall emissions levels. Other obligations remain unrealised too.

We need to build upon the existing Convention and its Protocol. This is paramount, if we are to build trust and move forward in a constructive way.

We take note that the latest IPCC report points to the need for political responses that match the climate change science. Yet we need to balance this out and emphasise that these political responses must also encompass the other two pillars of sustainable development — social progress and economic advancement, or stated in another way, the right to develop and hence to make greater use of energy.

For the 2.4 billion people that have no means of acquiring modern fuels for cooking and heating, emissions reductions are not on the agenda. Their daily struggles are focused on combating the worst pollutant of all: poverty.

For these people, our goals must be to make sure they have access to modern energy services that are reliable, affordable, economically viable, socially acceptable and environmentally sound. This will not only enhance their living standards, but also help them adapt better to the inevitable consequences of climate change.

We do not believe that any new deal will succeed if it simply seeks to put additional economic burdens on developing countries. Even though climate change is clearly a challenge for the international community at large, there must be no losers, and it is unfair and unrealistic to ask for more stringent commitments for developing countries over and above those already embraced by them in the Kyoto Protocol.
OPEC believes that technology can play a significant role in helping us find solutions, but this technology must be shared on a level playing field just like we “share” the negative effects of climate change. If we truly regard this as a global threat, we cannot treat climate change as simply another business opportunity; hence, technology transfer must be viewed in a more inclusive manner.

With fossil fuels expected to continue in the foreseeable future to play a dominant role in the energy mix, it is important to promote the development and dissemination of cleaner fossil fuel technologies, in particular for oil and gas. One such technology is carbon capture and storage, a mature technology and perhaps the single best means to reduce CO2 emissions.

However, technology solutions will be varied and no one solution will apply to all countries, nor will technology alone solve this problem. We must not lose sight of this. Cooperation, unity and dialogue also have a very important role to play.

Excellencies, ladies and gentlemen,

OPEC remains committed to its longstanding policy of promoting market stability and providing a reliable and regular supply of a very valuable resource to the world. It also appreciates the positive role that oil has played in the past and will play in the future to raise the living standards of people all over the world.

We acknowledge the interrelationships between energy production and consumption, environmental protection and preservation and economic growth and social development. And we will continue to work with international community towards all global efforts aimed at bridging the development gap and making energy accessible to the world’s poor, while protecting the environment through the avoidance of the unwanted side effects of the wasteful use of these energy resources.
What we need in place is a fair agreement that addresses the issues and challenges in a comprehensive, balanced and effective manner. One that takes into account the past, present and future; one where current commitments are fulfilled; one in which we can all see the benefits to be gained from our own efforts; and, one based on principles of solidarity with those least able to help themselves.

To these ends, we have witnessed some very interesting initiatives from various quarters. It has given me a positive feeling and I hope that we can continue to engage and work together in meeting the climate change challenge in a manner that will provide benefits for us all.

Thank you.

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**NigComSat-1**


The satellite, which is the third Nigerian satellite to be placed into [orbit](https://en.wikipedia.org/wiki/Orbit), was launched into a [geosynchronous transfer orbit](https://en.wikipedia.org/wiki/Geosynchronous_transfer_orbit) and subsequently it was successfully inserted into a [geosynchronous orbit](https://en.wikipedia.org/wiki/Geosynchronous_orbit), positioned at 42°E. It had a launch mass of 5,150 [kg](https://en.wikipedia.org/wiki/Kilogram), and has an expected service life of 15 years.

It is based on the Chinese [DFH-4 satellite bus](https://en.wikipedia.org/wiki/DFH-4), and carries a variety of [transponders](https://en.wikipedia.org/wiki/Transponder):
- 4 C-band
- 14 Ku-band
- 8 Ka-band
- 2 L-band

It will provide coverage to many parts of Africa, and the Ka-band transponders will also cover parts of Italy.

<table>
<thead>
<tr>
<th><strong>General information</strong></th>
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<tr>
<td><strong>Launch Date</strong></td>
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<tr>
<td><strong>Launch Mass</strong></td>
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<td><strong>Orbit Mass</strong></td>
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<td><strong>Manufacturer</strong></td>
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<td><strong>Launcher / Flight Number</strong></td>
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<td><strong>Lifetime</strong></td>
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<th><strong>Transponder Information</strong></th>
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<td><strong>EIRP</strong></td>
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<th><strong>Sundries</strong></th>
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<tr>
<td><strong>Expendable Energy</strong></td>
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<tr>
<td>Location</td>
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<td>-------------------</td>
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<tr>
<td>Former location</td>
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<tr>
<td>Current location</td>
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</table>

**List of broadcast satellites**

**NigeriaSat-1**

Did you know that there’s a **Nigerian Satellite** known as **NigeriaSat-1** in orbit? It was launched from Russia on the 27th of September, 2003.

- The second United States Mars rover is called SPIRIT, the first is known as **OPPORTUNITY**
- The Burj Al Arab is the only 7 star hotel in the world—is very much a giant sail; its exoskeleton is comprised of a woven, Teflon-coated fiberglass cloth. Not only is this the tallest hotel on Earth, but it’s also "the world's tallest structure with a membrane façade"

- African games

The first All Africa Games were held in Congo (Brazzaville) in 1965. Since 1987 they have been established in a 4-year cycle held the year before the Olympics and from 1991 have been restricted to an U-23 competition with only three over-age players allowed. The **Olympics** counterpart is also an U23 event.

For the first time in history there was also a **women's** soccer tournament.
Both the men and women's tournaments are restricted to players under 23 years of age.

**Past Winners**

<table>
<thead>
<tr>
<th>Year</th>
<th>Winner</th>
<th>Runner-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>Cameroon</td>
<td>Zambia</td>
</tr>
<tr>
<td>1995</td>
<td>Egypt</td>
<td>Zimbabwe</td>
</tr>
<tr>
<td>1991</td>
<td>Cameroon</td>
<td>Tunisia</td>
</tr>
<tr>
<td>1987</td>
<td>Egypt</td>
<td>Kenya</td>
</tr>
<tr>
<td>1978</td>
<td>Algeria</td>
<td>Nigeria</td>
</tr>
<tr>
<td>1973</td>
<td>Nigeria</td>
<td>Guinea</td>
</tr>
<tr>
<td>1965</td>
<td>Congo</td>
<td>Mali</td>
</tr>
</tbody>
</table>

**Past Venues**

<table>
<thead>
<tr>
<th>Year</th>
<th>City</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>Jo'burg</td>
<td>South Africa</td>
</tr>
<tr>
<td>1995</td>
<td>Harare</td>
<td>Zimbabwe</td>
</tr>
<tr>
<td>1991</td>
<td>Cairo</td>
<td>Egypt</td>
</tr>
<tr>
<td>1987</td>
<td>Nairobi</td>
<td>Kenya</td>
</tr>
<tr>
<td>1978</td>
<td>Algiers</td>
<td>Algeria</td>
</tr>
<tr>
<td>1973</td>
<td>Lagos</td>
<td>Nigeria</td>
</tr>
<tr>
<td>1965</td>
<td>Brazzaville</td>
<td>Congo</td>
</tr>
</tbody>
</table>

- **AFRICAN CUP OF NATIONS**

Has been played since 1957, and is thereby older than the corresponding European championship. The tournament is held every two years, and the number
of teams participating in the final tournament has continually increased and reached 16 for the first time in 1998.

- 26th GHANA (JANUARY 20 – FEBRUARY 20)

*Past Winners*

<table>
<thead>
<tr>
<th>Year</th>
<th>Winner</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Egypt</td>
<td>Egypt</td>
</tr>
<tr>
<td>2004</td>
<td>Tunisia</td>
<td>Tunisia</td>
</tr>
<tr>
<td>2002</td>
<td>Cameroon</td>
<td>Mali</td>
</tr>
<tr>
<td>2000</td>
<td>Cameroon</td>
<td>Nigeria &amp; Ghana</td>
</tr>
<tr>
<td>1998</td>
<td>Egypt</td>
<td>Burkina Faso</td>
</tr>
<tr>
<td>1996</td>
<td>South Africa</td>
<td>South Africa</td>
</tr>
</tbody>
</table>

**Olympic Games**

**Motto**

The Olympic motto is *Citius, Altius, Fortius*, which is Latin for "Faster, Higher, Stronger". The motto was proposed by Pierre de Coubertin on the creation of the International Olympic Committee in 1894. De Coubertin borrowed it from his friend Henri Didon, a Dominican priest who, amongst other things, was an athletics enthusiast. The motto was installed in 1896 at the first modern Olympic Games.

The motto was also the name of an Olympic history journal from 1992 to 1997, when it was renamed the *Journal of Olympic History.*
An more informal well known motto, also introduced by De Coubertin, is "The most important thing is not to win but to take part!". De Coubertin got this motto from a sermon by the Bishop of Pennsylvania, during the 1908 London Games.

**Olympic emblem**

The emblem of the Olympic Games is composed of five interlocking rings (blue, yellow, black, green, and red respectively) on a white field. This was originally designed in 1913 by Baron Pierre de Coubertin, the founder of the modern Olympic Games. Upon its initial introduction, de Coubertin stated the following in the August, 1913 edition of *Revue Olympique*:

> The emblem chosen to illustrate and represent the world Congress of 1914...: five intertwined rings in different colours - blue, yellow, black, green, red - are placed on the white field of the paper. These five rings represent the five parts of the world which now are won over to Olympism and willing to accept healthy competition.

In his article published in the "Olympic Revue" the official magazine of the International Olympic Committee in November 1992, the American historian Robert Barney explains that the idea of the interlaced rings came to Pierre de Coubertin when he was in charge of the USFSA (Union des Sociétés Française de Sports Athlétiques) an association founded by the union of a two French sports associations and until 1925, responsible for representing the International Olympic Committee in France: The emblem of the union was two interlaced rings (like the *vesica piscis* typical interlaced marriage rings) and originally the idea of Swiss psychiatrist Carl Jung because for him the ring meant continuity and the human being.[1]

The 1914 Congress had to be suspended due to the outbreak of World War I, but the emblem (and flag) were later adopted. They would first officially debut at the VIIth Olympiad in Antwerp, Belgium in 1920.
The emblem's popularity and widespread use began during the lead-up to the 1936 Summer Olympics in Berlin. Carl Diem, president of the Organizing Committee of the 1936 Summer Olympics, wanted to hold a torchbearers' ceremony in the stadium at Delphi, site of the famous oracle, where the Pythian Games were also held. For this reason he ordered construction of a milestone with the Olympic rings carved in the sides, and that a torchbearer should carry the flame along with an escort of three others from there to Berlin. The ceremony was celebrated but the stone was never removed. Later, two British authors Lynn and Gray Poole when visiting Delphi in the late 1950s saw the stone and reported in their "History of the Ancient Games" that the Olympic rings design came from ancient Greece. This has become known as "Carl Diem's Stone". This created a myth that the symbol had an ancient Greek origin. The rings would subsequently be featured prominently in Nazi images in 1936 as part of an effort to glorify the Third Reich.

The current view of the International Olympic Committee is that the emblem "reinforces the idea" that the Olympic Movement is international and welcomes all countries of the world to join. As can be read in the Olympic Charter, the Olympic symbol represents the union of the five continents and the meeting of athletes from throughout the world at the Olympic Games. However, no continent is represented by any specific ring. Though colourful explanations about the symbolism of the coloured rings exist, the only connection between the rings and the continents is that the number five refers to the number of continents. In this scheme, the Americas are viewed as a single continent, and Antarctica is omitted.

The Olympic Games (often referred to simply as The Olympics or The Games) is an international multi-sport event subdivided into summer and winter sporting events. The summer and winter games are each held every four years (an Olympiad). Until 1992, they were both held in the same year. Since then, they have been separated two years apart.
The original Olympic Games (Greek: Ολυμπιακοί Αγώνες; Olympiakoi Agones) began in 776 BC in Olympia, Greece, and was celebrated until AD 393. Interest in reviving the Olympic Games proper was first shown by the Greek poet and newspaper editor Panagiotis Soutsos in his poem "Dialogue of the Dead" in 1833. Evangelos Zappas sponsored the first modern international Olympic Games in 1859. He paid for the refurbishment of the Panathinaiko Stadium for Games held there in 1870 and 1875. This was noted in newspapers and publications around the world including the London Review, which stated that "the Olympian Games, discontinued for centuries, have recently been revived! Here is strange news indeed ... the classical games of antiquity were revived near Athens". The International Olympic Committee was founded in 1894 on the initiative of a French nobleman, Pierre Frédy, Baron de Coubertin. The first of the IOC's Olympic Games were the 1896 Summer Olympics, held in Athens, Greece. Participation in the Olympic Games has increased to include athletes from nearly all nations worldwide. With the improvement of satellite communications and global telecasts of the events, the Olympics are consistently gaining supporters. The most recent Summer Olympics were the 2004 Games in Athens and the most recent Winter Olympics were the 2006 Games in Turin. The upcoming games in Beijing are planned to comprise 302 events in 28 sports. As of 2006, the Winter Olympics were competed in 84 events in 7 sports.

NIGERIA PROFILE

LOCATION:
Nigeria is situated on the west coast of Africa, lies on latitudes 4° north of the Equator and latitudes 3° and 14° on the east of the Greenwich Meridian. Shares boundaries with The Republics of Benin and Niger in the west, Cameroon in the East, Niger and Chad in the north and the Gulf of Guinea in the South

Area:
923,768.64sq. Kilometers

**Capital:**
Abuja

**Population:**
About 137 Million People Consisting of 374 ethical groups with Hausa, Igbo, Yoruba constituting the major languages Official Language: English

**National Day:**
October 1st

**Currency:**
Naira=100 kobo

**Time:**
GMT + 1Hour

**Weights and Measures:**
Metric

**Political Structure:**
Three-tier structure: A Federal Government, Federal Capital Territory and 774 Local Governments

**Main Commercial/Industrial Cities:**
Lagos, Kano, Onitsha, Ibadan, Aba, jos, Warri, Maiduguri, Oshogbo etc.

**Major Industrial Complexes:**

Energy:

Hydroelectric: Kainji, Jebba, Shiroro.

National Grid for distribution:

National Pipeline Network with regional deposit for Petroleum product distribution.

Climate:

Like most African countries, the climate is tropical with two main marked seasons. The dry season lasting from November to March with the dry dust-laden North-easterly winds blowing across the country. The rainy season is from April to October. During this period the moisture-laden south-westerly winds blow from the coast bringing in the rains. Rainfall decrease from about 1,5000mm in the south to about 500mm in the North. The temperature is generally high, ranging...
between 220°C and 340°C except the Jos Plateau, the Mambila Plateau and the Obudu Cattle Ranch Plateau were the temperature is relatively cooler all year round.

GAS INVESTMENT OPPORTUNITIES

A lot of investment opportunities abound in the natural gas sector of the Nigerian petroleum industry. Increasing attention is now being given to this vital sector. Government's aspirations for the gas sector include creating new industries out of the old oil industry; capturing economic value and generating as much revenue from gas as from oil by 2010. Others are developing the domestic gas market and, ending gas flaring by 2008.

Remarkable progress has been recorded towards the realization of these objectives. Of the current annual gas production of about 2,000 Bscf, about 40% is flared. This is a drastic drop from the 70% proportion flared before the advent of this administration. The hitherto flared gas is being channeled into gas powered projects for rapid utilization and monetization with a view to maximizing value addition to the nation’s natural gas resource by 2010.
Domestic gas consumption is expanding as a result of the ongoing power sector reforms while gas export which was non-existent prior to 1999, has received a strong boost.

Comprehensive and integrated gas utilization Master plan/programmes have been embarked upon, in which LNG and IPP developments are being given priority. The expected increased export earnings from LNG, coupled with adequate domestic power supply from IPPs, will strongly support and broaden economic expansion and urbanization, increase the income generating capacity of Nigerians and lift the general wellbeing. It will further reinforce Government’s efforts towards integrating the Host communities into the mainstream of national development and growth.

Many gas-based projects are being undertaken in line with Governments aspirations in the sector. They include:

*Gas Projects*

**Domestic Gas Market Expansion**

As a result of various projects established, total gas utilized in the country increased from about 197 million scf/d in 1999 to about 573 mmcf/d in 2004. Substantial demand growth is expected in this decade. Consequently, domestic demand for natural gas is expected to increase to about 1700mmcf/d by 2010. Investment opportunities therefore abound in the domestic gas market

*Independent Power Plants*
Government is encouraging JV and PSC multinational oil companies operating in Nigeria to embark on IPPs, as part of the Power Sector reform. The Reform Act reviewed the generation, transmission and distribution of electricity in the country to improve its performance. The IPPs will not only boost electricity supply but also, provide necessary infrastructural support for economic growth, and also guarantee additional revenue to the participating JV/PSC companies. The IPPs will further strengthen the oil companies' social responsibility in the local economy as well as protect the environment through environmentally sustainable operations and industry best practices. The various IPPs are expected to contribute about 3000 MW to the national grid by 2007. This strategy will ensure the realization of Government’s intention to increase the national electricity generation from the current 4,000 MW to about 10,000 MW by 2010 to enhance economic activities.

The Liquefied Natural Gas Projects.

Since production started from trains 1& 2 in 1999, NLNG has been one of the fastest growing endeavours in the world. Train 3 was commissioned in November 2002 while 4 and 5 are expected to be on stream soon. When Train 6 is added in 2007, LNG output will total about 22 metric tons per annum. In addition, the Brass LNG with 2 trains and an output of 10mtpa is expected to be on stream in the first quarter of 2009 while the Olokola (OK) LNG which is a 4 train plant with an output of 20mtpa will have the first 2 trains commissioned in 2009/2010.

The West Africa Gas Pipeline

The Final Investment Decision of the West Africa Gas Pipeline was signed on 16th December 2004. The initial capacity utilization of the pipeline which is 200 mmcf/d is expected to increase to about 460 mmcf/d by 2026. This project which is of strategic importance is expected to foster cooperation and economic
development in the sub-region in the spirit of the New Partnership for African Development (NEPAD).

The Tran Saharan Gas Pipeline.

A Tran Saharan gas pipeline running from Nigeria to Algeria is under consideration. The objective is to make Nigerian piped gas available to Europe. The technical and commercial viability of this project is however being studied through a feasibility study being undertaken by a consultant on behalf of NNPC and Sonatrach.

Gas to Liquids & Natural Gas Liquids

These include the Escravos Gas- to- Liquids with a capacity of 34,000 barrels per day, the Escravos Natural Gas Liquids 1, 2 & 3 as well as the Mobil Natural Gas Liquids 1& 2.

In totality, on going gas transmission programmes would entail commercialization of about 14,750 mmmscf/d of gas by 2011 (80% for LNG). However, about $2.5billion will be required annually in stable investments (upstream and LNG plants) to capture opportunities in gas and power by 2010. The private sector therefore has a critical role to play in the realization of these and other projects. With these developments in the gas sector as well as the transformation in the upstream, it is believed that energy sector driven initiatives could contribute up to 60% towards doubling of the nation's GDP over the next 10 years.

Niger Delta

The Niger Delta, the delta of the Niger River in Nigeria, is a densely populated region sometimes called the Oil Rivers because it was once a major producer of
palm oil. The area was the British Oil Rivers Protectorate from 1885 until 1893, when it was expanded and became the Niger Coast Protectorate.

View of the Niger Delta from space. North is on the left.

The Niger Delta, as now defined officially by the Nigerian Government, extends over about 70,000 km² and makes up 7.5% of Nigeria's land mass. Historically and cartographically, it consists of present day Bayelsa, Delta and Rivers States. In the year 2000, however, Obansanjo's regime expanded it's definition to include Abia State, Akwa Ibom State, Cross River State, Edo State, Imo State and Ondo State. Some 20 million people of more than 40 ethnic groups, speaking some 250 dialects live in the Delta; the Ijaw being in the majority. Their livelihoods are primarily based on fishing and farming.

Coincidentally, Nigeria has become Africa's biggest producer of petroleum, including many oil wells in the Oil Rivers. Some 2 million barrels a day are extracted in the Niger Delta. Since 1975, the region has accounted for more than 75% of Nigeria's export earnings. Much of the natural gas extracted in oil wells in the Delta is immediately burned, or flared, into the air at a rate of approximately 70 million m³ per day. This is equivalent to 40% of African natural gas consumption, and forms the single largest source of greenhouse gas emissions on the planet. The environmental devastation associated with the industry and the lack of distribution of oil wealth have been the source and/or key aggravating factors of numerous environmental movements and inter-ethnic conflicts in the
region, including recent guerilla activity by the Movement for the Emancipation of the Niger Delta (MEND)

**Oil revenue derivation**

Oil revenue allocation has been the subject of much contention well before Nigeria gained its independence. allocations have varied from as much as 50%, owing to the First Republic's high degree of regional autonomy, and as low as 10% during the military dictatorships.

<table>
<thead>
<tr>
<th>Year</th>
<th>Federal</th>
<th>State*</th>
<th>Local</th>
<th>Special Projects</th>
<th>Derivation Formula**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1958</td>
<td>40%</td>
<td>60%</td>
<td>0%</td>
<td>0%</td>
<td>50%</td>
</tr>
<tr>
<td>1968</td>
<td>80%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>1977</td>
<td>75%</td>
<td>22%</td>
<td>3%</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>1982</td>
<td>55%</td>
<td>32.5%</td>
<td>10%</td>
<td>2.5%</td>
<td>10%</td>
</tr>
<tr>
<td>1989</td>
<td>50%</td>
<td>24%</td>
<td>15%</td>
<td>11%</td>
<td>10%</td>
</tr>
<tr>
<td>1995</td>
<td>48.5%</td>
<td>24%</td>
<td>20%</td>
<td>7.5%</td>
<td>13%</td>
</tr>
<tr>
<td>2001</td>
<td>48.5%</td>
<td>24%</td>
<td>20%</td>
<td>7.5%</td>
<td>13%</td>
</tr>
</tbody>
</table>
* State allocations are based on 5 criteria: equality (equal shares per state), population, social development, land mass, and revenue generation.

**The derivation formula refers to the percentage of the revenue oil producing states retain from taxes on oil and other natural resources produced in the state. World Bank Report

[edit] Recent Destabilisation


Activities of local indigenous people against commercial oil refineries and pipelines have destabilized the region. Recently foreign employees of Shell, the primary corporation operating in the region, were taken hostage by outraged local people. Such activities have also resulted in greater governmental concern with the area, and the mobilisation of the Nigerian army and coastguard into the region.

In April, 2006, a bomb exploded near an oil refinery in the Niger Delta region, a warning against Chinese expansion in the region. MEND stated: “We wish to warn the Chinese government and its oil companies to steer well clear of the Niger Delta. The Chinese government by investing in stolen crude places its citizens in our line of fire.”[1]

Government and private initiatives to develop the Niger Delta region have been introduced recently. These include the Niger Delta Development Commission (NDDC [2]), a Government initiative, and the Development Initiative (DEVIN [3]), a community development non-governmental organization (NGO) based in Port Harcourt in the Niger Delta. Uz and Uz Transnational [4], a company with strong commitment to the Niger Delta, has introduced ways of developing the poor in the Niger Delta, especially in Rivers State.
It should not be confused with the Inner Niger Delta, also known as the Niger Inland Delta, in Mali.

See also

- Petroleum in Nigeria
- Niger Delta conflicts
- Nigerian Oil Crisis
- Niger Delta Development Commission (NDDC)
- Chanomi Creek

References

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- Environmental Rights Action
- UNDP Niger Delta Human Development Report

Nelson Mandela

Nelson Rolihlahla Mandela [IPA: [xolíːaɬa mandɛːla] (born 18 July 1918) is a former President of South Africa, the first to be elected in fully representative democratic elections. Before his presidency, Mandela was an anti-apartheid activist and leader of the African National Congress and its armed wing Umkhonto we Sizwe. He spent 27 years in prison, much of it in a cell on Robben Island, on convictions for crimes that included sabotage committed while he spearheaded the struggle against apartheid.
Among opponents of apartheid in South Africa and internationally, he became a symbol of freedom and equality, while the apartheid government and nations sympathetic to it condemned him and the ANC as communists and terrorists.

Following his release from prison in 1990, his switch to a policy of reconciliation and negotiation helped lead the transition to multi-racial democracy in South Africa. Since the end of apartheid, he has been widely praised, even by former opponents.

Mandela has received more than one hundred awards over four decades, most notably the Nobel Peace Prize in 1993. He is currently a celebrated elder statesman who continues to voice his opinion on topical issues. In South Africa he is often known as Madiba, an honorary title adopted by elders of Mandela's clan. The title has come to be synonymous with Nelson Mandela.

**Early life**

**Birth and lineage**

Mandela belongs to a cadet branch of the Thembu dynasty which (nominally) reigns in the Transkeian Territories of the Union of South Africa's Cape Province. He was born in the small village of Mvezo in the district of Umtata, the Transkei capital. His great-grandfather was Ngubengcuka (died 1832), the Inkosi Enkhulu or King of the Thembu people, who were eventually subjected to British colonial rule.
One of the king's sons, named Mandela, became Nelson's grandfather and the source of his surname. However, being only the Inkosi's child by a wife of the Ixhiba clan (the so-called "Left-Hand House"), the descendants of his branch of the royal family were not eligible to succeed to the Thembu throne. His father, Gadla Henry Mphakanyiswa (1880–1928), was nonetheless designated chief of the town of Mvezo. Upon alienating the colonial authorities, however, he was deprived of his position, and moved his family to Qunu. Gadla remained, however, a member of the Inkosi's Privy Council, and was instrumental in the ascension to the Thembu throne of Jongintaba Dalindyebo, who would later return this favour by informally adopting Mandela upon Gadla's death. Mandela's father had four wives, with whom he fathered a total of thirteen children (four boys and nine girls). Mandela was born to Gadla's third wife ('third' by a complex royal ranking system), Nosekeni Fanny, daughter of Nkedama of the Mpemvu Xhosa clan, the dynastic Right Hand House, in whose umzi or homestead Mandela spent much of his childhood. His given name Rolihlahla means "to pull a branch of a tree", or more colloquially, "troublemaker".

Education

At seven years of age, Rolihlahla Mandela became the first member of his family to attend a school, where he was given the name "Nelson," after the British admiral Horatio Nelson, by a Methodist teacher who found his native name difficult to pronounce. His father died of tuberculosis when Rolihlahla was nine, and the Regent, Jongintaba, became his guardian. Mandela attended a Wesleyan mission school next door to the palace of the Regent. Following Thembu custom, he was initiated at age sixteen, and attended Clarkebury Boarding Institute. He completed his Junior Certificate in two years, instead of the usual three. Destined to inherit his father's position as a privy councillor, in 1937 Mandela moved to Healdtown, the Wesleyan college in Fort Beaufort which most Thembu royalty attended. Aged nineteen, he took an interest in boxing and running.
After matriculating, he started to study for a B.A. at the Fort Hare University, where he met Oliver Tambo, and the two became lifelong friends and colleagues. He also became close friends with his kinsman, Kaiser ("K.D.") Matanzima who, however, as royal scion of the Thembu Right Hand House, was destined for the throne of Transkei, a role that later led him to embrace Bantustan policies which made him and Mandela political enemies. At the end of Nelson's first year, he became involved in a boycott by the Students' Representative Council against the university policies, and was asked to leave Fort Hare.

Later, while imprisoned, Mandela studied for a Bachelor of Laws from the University of London External Programme (see below).

**Move to Johannesburg**

Shortly after leaving Fort Hare, Jongintaba announced to Mandela and Justice (the Regent's own son and heir to the throne) that he had arranged marriages for both of them. Both young men were displeased by this and rather than marry, they elected to flee the comforts of the Regent's estate to go to Johannesburg. Upon his arrival, Mandela initially found employment as a guard at a mine. However, this was quickly terminated after the employer learned that Mandela was the Regent's runaway adopted son. He later started work as an articled clerk at a law firm thanks to connections with his friend, lawyer Walter Sisulu. While working there, he completed his B.A. degree at the University of South Africa via correspondence, after which he started with his law studies at the University of Witwatersrand. During this time Mandela lived in Alexandra township, north of Johannesburg.

**Political activity**

After the 1948 election victory of the Afrikaner-dominated National Party with its apartheid policy of racial segregation, Mandela was prominent in the ANC's 1952 Defiance Campaign and the 1955 Congress of the People, whose adoption of the Freedom Charter provided the fundamental program of the anti-apartheid cause. During this time, Mandela and fellow lawyer Oliver Tambo operated the law firm
of Mandela and Tambo, providing free or low-cost legal counsel to many blacks who would otherwise have been without representation.

Mandela's approach was influenced by Mahatma Gandhi, who inspired him and succeeding generations of South African anti-apartheid activists.[3][4] Indeed, Mandela took part in the 29 January – 30 January 2007 conference in New Delhi which marked the 100th anniversary of Gandhi's introduction of satyagraha in South Africa.[5]

Initially committed to non-violent mass struggle, Mandela was arrested with 150 others on 5 December 1956 and charged with treason. The marathon Treason Trial of 1956–61 followed, and all were acquitted.[citation needed] From 1952–59 the ANC experienced disruption as a new class of Black activists (Africanists) emerged in the townships demanding more drastic steps against the National Party regime. The ANC leadership of Albert Luthuli, Oliver Tambo and Walter Sisulu felt not only that events were moving too fast, but also that their leadership was challenged. They consequently bolstered their position by alliances with small White, Coloured and Indian political parties in an attempt to appear to have a wider appeal than the Africanists. The 1955 Freedom Charter Kliptown Conference was ridiculed by the Africanists for allowing the 100,000-strong ANC to be relegated to a single vote in a Congress alliance, in which four secretaries-general of the five participating parties were members of the secretly reconstituted South African Communist Party (SACP), strongly adhering to the Moscow line.[citation needed]

In 1959 the ANC lost its most militant support when most of the Africanists, with financial support from Ghana and significant political support from the Transvaal-based Basotho, broke away to form the Pan Africanist Congress (PAC) under Robert Sobukwe and Potlako Leballo.[citation needed]

**Guerrilla activities**

In 1961, Mandela became the leader of the ANC's armed wing, Umkhonto we Sizwe (translated as Spear of the Nation, also abbreviated as MK), which he co-founded.
He coordinated a sabotage campaign against military and government targets, and made plans for a possible guerrilla war if sabotage failed to end apartheid. A few decades later, MK did wage a guerrilla war against the regime, especially during the 1980s, in which many civilians were killed. Mandela also raised funds for MK abroad, and arranged for paramilitary training, visiting various African governments.

Mandela explains the move to embark on armed struggle as a last resort, when increasing repression and violence from the state convinced him that many years of non-violent protest against apartheid had achieved nothing and could not succeed.[6][2]

Mandela later admitted that the ANC, in its struggle against apartheid, also violated human rights, and has sharply criticised attempts by parts of his party to remove statements supporting this fact from the reports of the Truth and Reconciliation Commission.[7]

**Arrest and Rivonia trial**

*Main article: Rivonia Trial*

On 5 August 1962 Mandela was arrested after living on the run for seventeen months, and was imprisoned in the Johannesburg Fort. The arrest was made possible because the CIA tipped off the security police as to Mandela's whereabouts and disguise.[8][9][10] Three days later, the charges of leading workers to strike in 1961 and leaving the country illegally were read to him during a court appearance. On 25 October 1962, Mandela was sentenced to five years in prison. Two years later on 11 June 1964, a verdict had been reached concerning his previous engagement in the African National Congress (ANC).

While Mandela was imprisoned, police arrested prominent ANC leaders on 11 July 1963, at Liliesleaf Farm, Rivonia, north of Johannesburg. Mandela was brought in, and at the Rivonia Trial, Mandela, Ahmed Kathrada, Walter Sisulu, Govan Mbeki,
Andrew Mlangeni, Raymond Mhlaba, Elias Motsoaledi, Walter Mkwayi (who escaped during trial), Arthur Goldreich (who escaped from prison before trial), Denis Goldberg and Lionel "Rusty" Bernstein were charged by the chief prosecutor Dr. Percy Yutar, the deputy attorney-general of the Transvaal, with the capital crimes of sabotage (which Mandela admitted) and crimes which were equivalent to treason, but easier for the government to prove. The second charge accused the defendants of plotting a foreign invasion of South Africa, which Mandela denied.

In his statement from the dock at the opening of the defence case in the trial on 20 April 1964 at Pretoria Supreme Court, Mandela laid out the clarity of reasoning in the ANC's choice to use violence as a tactic. His statement revealed how the ANC had used peaceful means to resist apartheid for years until the Sharpeville Massacre. That event coupled with the referendum establishing the Republic of South Africa and the declaration of a state of emergency along with the banning of the ANC made it clear that their only choice was to resist through acts of sabotage. Doing otherwise would have been tantamount to unconditional surrender. Mandela went on to explain how they developed the Manifesto of Umkhonto we Sizwe on 16 December 1961 intent on exposing the failure of the National Party's policies after the economy would be threatened by foreigners' unwillingness to risk investing in the country. He closed his statement with these words:

“They are my lifetime I have dedicated myself to the struggle of the African people. I have fought against white domination, and I have fought against black domination. I have cherished the ideal of a democratic and free society in which all persons live together in harmony and with equal opportunities. It is an ideal which I hope to live for and to achieve. But if needs be, it is an ideal for which I am prepared to die.”

Bram Fischer, Vernon Berrange, Harry Schwarz, Joel Joffe, Arthur Chaskalson and George Bizos were part of the defence team that represented the accused. Harold Hanson was brought in at the end of the case to plead mitigation. All except Rusty
Bernstein were found guilty, but they escaped the gallows and were sentenced to life imprisonment on 12 June 1964. Charges included involvement in planning armed action, in particular four charges of sabotage, which Mandela admitted to, and a conspiracy to help other countries invade South Africa, which Mandela denied.

**Imprisonment**

Nelson Mandela was imprisoned on Robben Island where he remained for the next eighteen of his twenty-seven years in prison. On the island, he and others performed hard labour in a lime quarry. Prison conditions were very basic. Prisoners were segregated by race, with black prisoners receiving the fewest rations. Political prisoners were kept separate from ordinary criminals and received fewer privileges. Mandela describes how, as a D-group prisoner (the lowest classification) he was allowed one visitor and one letter every six months. Letters, when they came, were often delayed for long periods and made unreadable by the prison censors.[2]

Whilst in prison Mandela undertook study with the University of London by correspondence through its External Programme and received the degree of Bachelor of Laws. He was subsequently nominated for the position of Chancellor of the University of London in the 1981 election, but lost to Princess Anne.

In his 1981 memoir *Inside BOSS* secret agent Gordon Winter describes his involvement in a plot to rescue Mandela from prison in 1969: this plot was infiltrated by Winter on behalf of South African intelligence, who wanted Mandela to escape so as to be able to shoot him during recapture. The plot was foiled by British Intelligence.[13]

In March 1982 Mandela was transferred from Robben Island to Pollsmoor Prison, along with other senior ANC leaders Walter Sisulu, Andrew Mlangeni, Ahmed Kathrada and Raymond Mhlaba. It was speculated that this was to remove the influence of these senior leaders on the new generation of young black activists.
imprisoned on Robben Island, the so-called "Mandela University". However, National Party minister Kobie Coetzee says that the move was to enable discreet contact between them and the South African government.[citation needed]

In February 1985 President P.W. Botha offered Mandela conditional release in return for renouncing armed struggle. Coetzee and other ministers had advised Botha against this, saying that Mandela would never commit his organisation to giving up the armed struggle in exchange for personal freedom. Mandela indeed spurned the offer, releasing a statement via his daughter Zindzi saying "What freedom am I being offered while the organisation of the people remains banned? Only free men can negotiate. A prisoner cannot enter into contracts."[14]

The first meeting between Mandela and the National Party government came in November 1985 when Kobie Coetzee met Mandela in Volks Hospital in Cape Town where Mandela was being treated for prostate surgery. Over the next four years, a series of tentative meetings took place, laying the groundwork for further contact and future negotiations, but little real progress was made.[14]

Throughout Mandela's imprisonment, local and international pressure mounted on the South African government to release him, under the resounding slogan Free Nelson Mandela! In 1989, South Africa reached a crossroads when Botha suffered a stroke and was replaced as president by Frederik Willem de Klerk. De Klerk announced Mandela's release in February 1990.

Release

On 2 February 1990, State President F.W. de Klerk reversed the ban on the ANC and other anti-apartheid organisations, and announced that Mandela would shortly be released from prison. Mandela was released from Victor Verster Prison in Paarl on 11 February 1990. The event was broadcast live all over the world.
On the day of his release, Mandela made a speech to the nation. He declared his commitment to peace and reconciliation with the country’s white minority, but made it clear that the ANC's armed struggle was not yet over:

“Our resort to the armed struggle in 1960 with the formation of the military wing of the ANC (Umkhonto we Sizwe) was a purely defensive action against the violence of apartheid. The factors which necessitated the armed struggle still exist today. We have no option but to continue. We express the hope that a climate conducive to a negotiated settlement would be created soon, so that there may no longer be the need for the armed struggle.”

He also said his main focus was to bring peace to the black majority and give them the right to vote in both national and local elections.

**Negotiations**

Main article: Negotiations to end apartheid in South Africa

Following his release from prison, Mandela returned to the leadership of the ANC and, between 1990 and 1994, led the party in the multi-party negotiations that led to the country's first multi-racial elections.

In 1991, the ANC held its first national conference in South Africa after its unbanning, electing Mandela as President of the organisation. His old friend and colleague Oliver Tambo, who had led the organisation in exile during Mandela's imprisonment, became National Chairperson.[15]

Mandela's leadership through the negotiations, as well as his relationship with President F.W. de Klerk, was recognised when they were jointly awarded the Nobel Peace Prize in 1993. However, the relationship was sometimes strained, particularly so in a sharp exchange in 1991 when he furiously referred to De Klerk as the head of "an illegitimate, discredited, minority regime". The talks broke down following the Boipatong massacre in June 1992 when Mandela took the ANC out of
the negotiations, accusing De Klerk’s government of complicity in the killings.[16] However, talks resumed following the Bisho massacre in September 1992, when the spectre of violent confrontation made it clear that negotiations were the only way forward.[23]

Following the assassination of senior ANC leader Chris Hani in April 1993, there were renewed fears that the country would erupt in violence. Mandela addressed the nation appealing for calm, in a speech regarded as 'presidential' even though he was not yet president of the country at that time:

“Tonight I am reaching out to every single South African, black and white, from the very depths of my being. A white man, full of prejudice and hate, came to our country and committed a deed so foul that our whole nation now teeters on the brink of disaster. A white woman, of Afrikaner origin, risked her life so that we may know, and bring to justice, this assassin. The cold-blooded murder of Chris Hani has sent shock waves throughout the country and the world. ...Now is the time for all South Africans to stand together against those who, from any quarter, wish to destroy what Chris Hani gave his life for – the freedom of all of us.

While some riots did follow the assassination, the negotiators were galvanised into action, and soon agreed that democratic elections should take place on 27 April 1994, just over a year after Hani's assassination.[14]

**Autobiography**

Mandela’s autobiography, *Long Walk to Freedom*, was published in 1994. Mandela had begun work on it secretly while in prison. In that book Mandela did not reveal anything about the alleged complicity of F.W. de Klerk in the violence of the eighties and nineties, or the role of his ex-wife Winnie Mandela in that bloodshed. However, he later co-operated with his friend the journalist Anthony Sampson who discussed those issues in *Mandela: The Authorised Biography*. Another detail
that Mandela omitted was the allegedly fraudulent book, *Goodbye Bafana*. Its author, Robben Island warder James Gregory, claimed to have been Mandela's confidante in prison and published details of the prisoner's family affairs. Sampson maintained that Mandela had not known Gregory well, but that Gregory censored the letters sent to the future president and thus discovered the details of Mandela's personal life. Sampson also averred that other warders suspected Gregory of spying for the government and that Mandela considered suing Gregory.[17]

**Presidency of South Africa**

South Africa's first democratic elections in which full enfranchisement was granted were held on 27 April 1994. The ANC won 62% of the votes in the election, and Mandela, as leader of the ANC, was inaugurated on 10 May 1994 as the country's first black President, with the National Party's de Klerk as his first deputy and Thabo Mbeki as the second in the Government of National Unity.[18]

**Policy of reconciliation**

As President from May 1994 until June 1999, Mandela presided over the transition from minority rule and apartheid, winning international respect for his advocacy of national and international reconciliation.

Mandela encouraged black South Africans to get behind the previously hated Springboks (the South African national rugby team) as South Africa hosted the 1995 Rugby World Cup. After the Springboks won an epic final over New Zealand, Mandela, wearing a Springbok shirt, presented the trophy to captain Francois Pienaar, an Afrikaner. This was widely seen as a major step in the reconciliation of white and black South Africans.[citation needed]

After assuming the presidency, one of Mandela's trademarks was his use of Batik shirts, known as "Madiba shirts", even on formal occasions.

**Invasion of Lesotho**
In South Africa's first post-apartheid military operation, Mandela ordered troops into Lesotho in September 1998 to protect the government of Prime Minister Pakalitha Mosisili. This came after a disputed election prompted fierce opposition threatening the unstable government.[19]

Criticism of AIDS response

Commentators and critics including AIDS activists such as Edwin Cameron have criticised Mandela for his government's ineffectiveness in stemming the AIDS crisis.[20][21] After his retirement, Mandela admitted that he may have failed his country by not paying more attention to the HIV/AIDS epidemic.[22][23] He has since taken many opportunities to highlight this South African and international tragedy.

Lockerbie trial

President Mandela took a particular interest in helping to resolve the long-running dispute between Gaddafi's Libya, on the one hand, and the United States and Britain on the other, over bringing to trial the two Libyans who were indicted in November 1991 and accused of sabotaging Pan Am Flight 103, which crashed at the Scottish town of Lockerbie on 21 December 1988, with the loss of 270 lives. As early as 1992, Mandela informally approached President George Bush with a proposal to have the two indicted Libyans tried in a third country. Bush reacted favourably to the proposal, as did President Mitterrand of France and King Juan Carlos of Spain. In November 1994 – six months after his election as president – Mandela formally proposed that South Africa should be the venue for the Pan Am Flight 103 bombing trial.[24]

However, British Prime Minister, John Major, flatly rejected the idea saying the British government did not have confidence in foreign courts[25]. A further three years elapsed until Mandela's offer was repeated to Major's successor, Tony Blair, when the president visited London in July 1997. Later the same year, at the Commonwealth Heads of Government Meeting (CHOGM) at Edinburgh in October 1997, Mandela warned:
"No one nation should be complainant, prosecutor and judge."

President Mandela negotiated with Muammar Gaddafi the hand-over of two accused Libyans to stand trial.

A compromise solution was then agreed for a trial to be held at Camp Zeist in the Netherlands, governed by Scots law, and President Mandela began negotiations with Colonel Gaddafi for the handover of the two accused (Megrahi and Fhimah) in April 1999. At the end of their nine-month trial, the verdict was announced on 31 January 2001. Fhimah was acquitted but Megrahi was convicted and sentenced to 27 years in a Scottish jail. Megrahi's initial appeal was turned down in March 2002, and former president Mandela went to visit him in Barlinnie prison on 10 June 2002.

"Megrahi is all alone", Mandela told a packed press conference in the prison's visitors room. "He has nobody he can talk to. It is psychological persecution that a man must stay for the length of his long sentence all alone. It would be fair if he were transferred to a Muslim country — and there are Muslim countries which are trusted by the West. It will make it easier for his family to visit him if he is in a place like the kingdom of Morocco, Tunisia or Egypt."[27]

Megrahi was subsequently moved to Greenock jail and is no longer in solitary confinement. On June 28, 2007, the Scottish Criminal Cases Review Commission concluded its three-year review of Megrahi's conviction and, believing that a
miscarriage of justice may have occurred, referred the case to the Court of Criminal Appeal for a second appeal.[28]

**Marriage and family**

Mandela has been married three times, has fathered six children, has twenty grandchildren, and a growing number of great-grandchildren. His grandson is Chief Mandla Mandela.[29]

**First marriage**

Mandela's first marriage was to Evelyn Ntoko Mase who, like Mandela, was also from what later became the Transkei area of South Africa, although they actually met in Johannesburg. The couple had two sons, Madiba Thembekile (Thembi) (born 1946) and Makgatho (born 1950), and two daughters, both named Makaziwe (known as Maki; born 1947 and 1953). Their first daughter died aged nine months, and they named their second daughter in her honor. The couple broke up in 1957 after 13 years, divorcing under the multiple strains of his constant absences, devotion to revolutionary agitation, and the fact she was a Jehovah's Witness, a religion which requires political neutrality. Thembi was killed in a car crash in 1969 at the age of 25, while Mandela was imprisoned on Robben Island. All their children were educated at the Waterford Kamhlaba. Evelyn Mase died in 2004.

**Second marriage**

Mandela's second wife, Winnie Madikizela-Mandela, also came from the Transkei area, although they, too, met in Johannesburg, where she was the city's first black social worker. They had two daughters, Zenani (Zeni), born 4 February 1958, and Zindziswa (Zindzi), born 1960. Later, Winnie would be deeply torn by family discord which mirrored the country's political strife; while her husband was serving a life sentence on the Robben Island prison, her father became the
agriculture minister in the Transkei. The marriage ended in separation (April 1992) and divorce (March 1996), fuelled by political estrangement.

Mandela still languished in prison when his daughter Zenani was married to Prince Thombumuzi Dlamini in 1973, elder brother of King Mswati III of Swaziland. As a member by marriage of a reigning foreign dynasty, she was able to visit her father during his South African imprisonment while other family members were denied access. The Dlamini couple live and run a business in Boston. One of their sons, Prince Cedza Dlamini (born 1976), educated in the United States, has followed in his grandfather's footsteps as an international advocate for human rights and humanitarian aid. Thombumuzi and Mswati's sister, Princess Mantfombi Dlamini, is the chief consort to King Goodwill Zwelithini of KwaZulu-Natal, who "reigns but does not rule" over South Africa's largest ethnic group under the auspices of South Africa's government. One of Queen Mantfombi's sons is expected to eventually succeed Goodwill as monarch of the Zulus, whose Inkatha Party leader, Mangosuthu Buthelezi, was the rival of Mandela during much of his presidency.

Third marriage

Mandela himself was re-married in 1998, on his 80th birthday, to Graça Machel née Simbine, widow of Samora Machel, the former Mozambican president and ANC ally killed in an air crash 12 years earlier. The wedding followed months of international negotiations to set the unprecedented bride-price remitted to her clan, which were conducted on Mandela's behalf by his traditional sovereign, King Buyelekhaya Zwelibanzi Dalindyebo, born 1964. Ironically, it was this paramount chief's grandfather, the Regent Jongintaba, whose selection of a bride for him prompted Mandela to flee to Johannesburg as a young man.

Mandela still maintains a home at Qunu in the realm of his royal nephew (second cousin thrice-removed in Western reckoning), whose university expenses he defrayed and whose privy councillor he remains.[30]
**Retirement**

Mandela became the oldest elected President of South Africa when he took office at the age of 77 in 1994. He decided not to stand for a second term as President, and instead retired in 1999, to be succeeded by Thabo Mbeki.

**Health**

In July 2001 Mandela was diagnosed and treated for prostate cancer. He was treated with a seven week course of radiation. In June 2004, at age 85, Mandela announced that he would be retiring from public life. His health had been declining, and he wanted to enjoy more time with his family. Mandela said that he did not intend to hide away totally from the public, but wanted to be in a position "of calling you to ask whether I would be welcome, rather than being called upon to do things and participate in events. My appeal therefore is: Don't call me, I will call you." Since 2003, he has appeared in public less often and has been less vocal on topical issues. In his late 80s, he is white haired and walks slowly with the support of a stick.

In 2003 Mandela's death was incorrectly announced by CNN when his pre-written obituary (along with those of several other famous figures) was inadvertently published on CNN's web site due to a fault in password protection. In 2007 a fringe right-wing group distributed hoax emails and SMSs claiming that the authorities had covered up Mandela's death and that white South Africans would be massacred after his funeral. Mandela was on holiday in Mozambique at the time.

**Public activities**

After his retirement as President, Mandela went on to become an advocate for a variety of social and human rights organisations. He has expressed his support for the international Make Poverty History movement of which the ONE Campaign is a part.
Mandela appeared in a televised advertisement for the 2006 Winter Olympics, and was quoted for the International Olympic Committee’s Celebrate Humanity campaign:

> For seventeen days, they are roommates.
> For seventeen days, they are soulmates.
> And for twenty-two seconds, they are competitors.
> Seventeen days as equals. Twenty-two seconds as adversaries.
> What a wonderful world that would be.
> That’s the hope I see in the Olympic Games.

The Nelson Mandela Invitational charity golf tournament, hosted by Gary Player, has raised over R20 million for children's charities since its inception in 2000. This annual special event has become South Africa's most successful charitable sports gathering and benefits both the Nelson Mandela Children's Fund and Gary Player Foundation equally for various children's causes around the world.

**The Elders**

On 18 July 2007, Nelson Mandela, Graça Machel, and Desmond Tutu convened a group of world leaders in Johannesburg to contribute their wisdom and independent leadership to address the world's toughest problems. Nelson Mandela announced the formation of this new group, The Elders, in a speech he delivered on the occasion of his 89th birthday.

Archbishop Tutu will serve as the Chair of The Elders. The founding members of this group also include Graça Machel, Kofi Annan, Ela Bhatt, Gro Harlem Brundtland, Jimmy Carter, Li Zhaoxing, Mary Robinson and Muhammad Yunus.

"This group can speak freely and boldly, working both publicly and behind the scenes on whatever actions need to be taken," Mandela commented. "Together we will work to support courage where there is fear, foster agreement where there is conflict, and inspire hope where there is despair."
AIDS engagement

Since his retirement, one of Mandela's primary commitments has been to the fight against AIDS. In 2003, he had already lent his support to the 46664 AIDS fundraising campaign, named after his prison number. In July 2004, he flew to Bangkok to speak at the XV International AIDS Conference. His son, Makgatho Mandela, died of AIDS on 6 January 2005.

Iraq invasion views

In 2003 Mandela criticised the foreign policy of the George W. Bush administration in a number of speeches. Criticising the lack of UN involvement in the decision to begin the War in Iraq, he said, "It is a tragedy, what is happening, what Bush is doing. But Bush is now undermining the United Nations". Mandela stated he would support action against Iraq only if it is ordered by the UN. Mandela also insinuated that Bush may have been motivated by racism in not following the UN and its secretary-general Kofi Annan on the issue of the war. "Is it because the secretary-general of the United Nations is now a black man? They never did that when secretaries-generals were white".[40]

He urged the people of the U.S. to join massive protests against Bush and called on world leaders, especially those with vetoes in the UN Security Council, to oppose him. "What I am condemning is that one power, with a president who has no foresight, who cannot think properly, is now wanting to plunge the world into a holocaust." He attacked the United States for its record on human rights and for dropping atomic bombs on Japan during World War II. "If there is a country that has committed unspeakable atrocities in the world, it is the United States of America. They don't care."[40]

As a member of the United States House of Representatives in 1986, Dick Cheney had voted against a congressional resolution calling for Mandela's release from prison. In 2002, Mandela called Cheney a "dinosaur".[41]
Ismail Ayob was a trusted friend and personal attorney of Mandela for over 30 years. In May 2005, Ayob was asked by Mandela to stop selling prints signed by Mandela and to account for the proceeds of their sale. This bitter dispute led to an extensive application to the High Court of South Africa by Mandela that year. Ayob denied any wrongdoing and claimed that he was the victim of a smear campaign orchestrated by Mandela's advisors, in particular, lawyer George Bizos.

In 2005, and 2006 Ayob, his wife, and son were subject to an attack by Mandela's advisors. The dispute was widely reported in the media, with Ayob being portrayed in a negative light, culminating in the action by Mandela to the High Court. There were public meetings at which Mandela associates attacked Ayob and there were calls for Ayob and his family to be ostracised by society. The defence of Ismail and Zamila Ayob (his wife, and a fellow respondent) included documents signed by Mandela and witnessed by his secretaries, that, they claimed, refuted many of the allegations made by Nelson Mandela and his advisors.

The dispute again made headlines in February 2007 when, during a hearing in the Johannesburg High Court, Ayob promised to pay R700 000 to Mandela, which Ayob had transferred into trusts for Mandela's children, and apologised, although he later claimed that he was the victim of a "vendetta", by Mandela. Some media commentators expressed sympathy for Ayob's position, pointing out that Mandela's iconic status would make it difficult for Ayob to be treated fairly.

**Allegations**

Ayob, George Bizos and Wim Trengrove were trustees of the Nelson Mandela Trust, which was set up to hold millions of rands donated to Nelson Mandela by
prominent business figures, including the Oppenheimer family, for the benefit of his children and grandchildren. Ayob later resigned from the Trust. In 2006, the two remaining trustees of the Nelson Mandela Trust launched an application against Ayob for disbursing money from the trust without their consent. Ayob claimed that this money was paid to the South African Revenue Service, to Mandela's children and grandchildren to Mandela himself and to an accounting company for four years of accounting work.

Bizos and Trengrove refused to ratify the payments to the children and grandchildren of Nelson Mandela and the payments to the accounting firm. A court settlement was reached in which this money, totalling over R700,000 was paid by Ismail Ayob to the trust on the grounds that Ayob had not sought the express consent of the other two trustees before disbursing the money. It was alleged that Ayob made defamatory remarks about Mandela in his affidavit, for which the court order stated that Ayob should apologise. It was pointed out that these remarks, which centred on Nelson Mandela holding foreign bank accounts and not paying tax on these, had not originated from Ayob's affidavit but from Nelson Mandela's and George Bizos's own affidavits.

Blood Diamond controversy

In a The New Republic article in December 2006, Nelson Mandela was criticised for a number of positive comments he had made about the diamond industry, specifically regarding blood diamonds. In a letter to Edward Zwick, the director of the motion picture Blood Diamond, Mandela had noted that:

"...it would be deeply regrettable if the making of the film inadvertently obscured the truth, and, as a result, led the world to believe that an appropriate response might be to cease buying mined diamonds from Africa. ... We hope that the desire to tell a gripping and important real life historical story will not result in the destabilization of African diamond producing countries, and ultimately their peoples."
The *New Republic* article claims that this comment, as well as various pro-diamond-industry initiatives and statements during his life and during his time as a president of South Africa, were influenced by both his friendship with Harry Oppenheimer, former chairman of De Beers, as well as an outlook for 'narrow national interests' of South Africa (which is a major diamond producer).

**Zimbabwe and Robert Mugabe**

Robert Mugabe, the president of Zimbabwe who has led the country since independence in 1980, has been widely criticised internationally for the 1980s slaughter of 20,000 Matabele people as well as corruption, incompetent administration, political oppression and cronyism that has ultimately led to the economic collapse of the country.

Mandela criticised Mugabe's government in 2000,[55][56] but since around 2003, in his retirement, Mandela has been silent on Zimbabwe and other international and domestic issues.[33] This has sometimes led to Mandela being criticised for not using his influence to more effect to persuade Mugabe to moderate his policies.[57]

**Acclaim**

Fighter for liberation of South Africa Nelson Mandela on the 1988 USSR commemorative stamp
Mandela has received many South African, foreign and international honours, including the Nobel Peace Prize in 1993 (which was shared with Frederik Willem de Klerk), the Order of Merit and the Order of St. John from Queen Elizabeth II and the Presidential Medal of Freedom from George W. Bush. In July 2004, the city of Johannesburg bestowed its highest honour on Mandela by granting him the freedom of the city at a ceremony in Orlando, Soweto.

As an example of his popular foreign acclaim, during his tour of Canada in 1998, 45,000 school children greeted him with adulation at a speaking engagement in the SkyDome in the city of Toronto. In 2001, he was the first living person to be made an honorary Canadian citizen (the only previous recipient, Raoul Wallenberg, was awarded honorary citizenship posthumously). While in Canada, he was also made an honorary Companion of the Order of Canada, one of the few foreigners to receive Canada's highest honour.

In 1990 he received the Bharat Ratna Award from the government of India.

In 1992 he was awarded the Atatürk Peace Award by Turkey. He refused the award citing human rights violations committed by Turkey at the time, but later accepted the award in 1999.[58]

**Musical tributes**

Many artists have dedicated songs to Mandela. One of the most popular was from the The Specials who recorded the song Nelson Mandela in 1983. Stevie Wonder dedicated his 1985 Oscar for the song I Just Called to Say I Love You to Mandela, resulting in his music being banned by the South African Broadcasting Corporation.[59] In 1985, Youssou N'Dour's album Nelson Mandela was the Senegalese artist's first United States release.
In 1988, the Nelson Mandela 70th Birthday Tribute concert at London's Wembley Stadium was a focal point of the anti-apartheid movement, with many musicians voicing their support for Mandela. Jerry Dammers, the author of Nelson Mandela, was one of the organisers. Simple Minds recorded the song Mandela Day for the concert, Santana recorded the instrumental Mandela, and Tracy Chapman performed Freedom Now, dedicated to Mandela and released on her album Crossroads. Salif Keita from Mali, who played at the concert, later visited South Africa and in 1995 recorded the song Mandela on his album Folon.

In South Africa, Asimbonanga (Mandela) (we have not seen him) became one of Johnny Clegg's most famous songs, appearing on his Third World Child album in 1987. Hugh Masekela, in exile in the UK, sang Bring Him Back Home (Nelson Mandela) in 1987. Brenda Fassie's 1989 song Black President, a tribute to Mandela, was hugely popular even though it was banned in South Africa.[60]

In 1990, Hong Kong Cantopop band Beyond released a popular Cantonese song, "Days of Glory". The anti-apartheid song featured lyrics referring to Mandela's heroic struggle for racial equality.[61]

In 2003, Mandela lent his weight to the 46664 campaign against AIDS, named after his prison number. Many prominent musicians performed in concerts as part of this campaign.

A summary of Mandela's life story is featured in the 2006 music video If Everyone Cared by Nickelback.

**Cinema**

In 1997, the film Mandela and De Klerk told the story of Mandela's release from prison. Mandela was played by Sidney Poitier. Goodbye Bafana, a feature film that focuses on Mandela's life, had its world premiere at the Berlin film festival on 11 February 2007. The film starred Dennis Haysbert as Mandela and chronicled Mandela's relationship with prison guard James Gregory.
In the final scene of the 1992 movie *Malcolm X*, Mandela – recently released after 27 years of political imprisonment – appears as a schoolteacher in a Soweto classroom. He recites a portion of one of Malcolm X’s most famous speeches, including the following sentence: "We declare our right on this earth to be a human being, to be respected as a human being, to be given the rights of a human being in this society, on this earth, in this day, which we intend to bring into existence..." The final phrase of that sentence is "by any means necessary." Mandela informed director Spike Lee that he could not utter this phrase on camera, stating that the apartheid government would somehow use it against him if he did. Lee understandingly obliged, and the final seconds of the film feature black-and-white footage of the real Malcolm X speaking the words "by any means necessary". [citation needed]

The statue of Mandela in Parliament Square, London.

**Statues**

On 31 March 2004, Sandton Square was renamed *Nelson Mandela Square*, after a 6-metre statue of Nelson Mandela was installed on the square to honour the famous South African statesman.

On 29 August 2007, a statue of Nelson Mandela was unveiled at Parliament Square in London by Richard Attenborough, Ken Livingstone, Wendy Woods, and Gordon Brown. The campaign to erect the statue was started in 2000 by the late Donald
Woods, a South African journalist driven into exile because of his anti-apartheid activities. Mandela stated that it represented not just him, but all those who have resisted oppression, especially those in South Africa. He also said, "The history of the struggle in South Africa is rich with the stories of heroes and heroines, some of them leaders, some of them followers. All of them deserve to be remembered."[62]

References

13. ^ Lobster Magazine 18
24. ^ Families say SA trial site acceptable
25. ^ The Guardian 11 May 1999 page 13 "Mandela's parting shot at Major over Lockerbie"
28. ^ SCCRC refers Megrahi's case back for a second appeal


60. "Brenda Fassie dies", BBC.


- Galileo experiment on falling objects was conducted at the leaning tower of Pisa
- World health day - 7th April
- World AIDS day – 1 December
### Public holidays in Nigeria

<table>
<thead>
<tr>
<th>Holiday</th>
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<tr>
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<tr>
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### International days

- **8 March** - [International Women's Day](https://www.un.org/womenwatch/daw/3m/)
- **21 March** - [International Day for the Elimination of Racial Discrimination](https://www.un.org/en/rights-day/)
- **22 March** - [World Day for Water](https://www.unwater.org/worldwaterday/)
- **24 March** - [World Tuberculosis Day (WHO)](https://www.who.int_TB/)
- **7 April** - [World Health Day (WHO)](https://www.who.int/mediacentre/events/world-health-day)
- **3 May** - [Sun Day (UNEP)](https://www.unep.org/)

*Note: The document contains links to external sites for more information.*
3 May - World Press Freedom Day (UNESCO)
15 May - International Day of Families
17 May - World Telecommunication and Information Society Day (ITU)
21 May - World Day for Cultural Diversity for Dialogue and Development (UNESCO)
22 May - International Day for Biological Diversity
25 May - Africa Day
Beginning 25 May - Week of Solidarity with the Peoples of Non-Self-Governing Territories
31 May - World No-Tobacco Day (WHO)

4 June - International Day of Innocent Children Victims of Aggression (in French)
5 June - World Environment Day (UNEP)
17 June - World Day to Combat Desertification and Drought
20 June - World Refugee Day
23 June - United Nations Public Service Day
26 June - International Day against Drug Abuse and Illicit Trafficking
26 June - United Nations International Day in Support of Victims of Torture

1st Saturday of July - International Day of Cooperatives
11 July - World Population Day (UNFPA)

9 August - International Day of the World's Indigenous People
12 August - International Youth Day
23 August - International Day for the Remembrance of the Slave Trade and its Abolition (UNESCO)

8 September - International Literacy Day (UNESCO)
16 September - International Day for the Preservation of the Ozone layer
21 September - International Day of Peace
Last week of September - World Maritime Day (IMO)
1 October - International Day of Older Persons
1st Monday of October - World Habitat Day
4-10 October - World Space Week
5 October - World Teachers' Day (UNESCO)
9 October - World Post Day (UPU)
10 October - World Mental Health Day
2nd Wednesday of October - International Day for Natural Disaster Reduction
16 October - World Food Day (FAO)
17 October - International Day for the Eradication of Poverty
24 October - United Nations Day
24 October - World Development Information Day
24-30 October - Disarmament Week
27 October - World Day for Audiovisual Heritage (UNESCO)

6 November - International Day for Preventing the Exploitation of the Environment in War and Armed Conflict
10 November - World Science Day for Peace and Development (UNESCO)
3rd Thursday of November - World Philosophy Day (UNESCO)
16 novembre - International Day of Tolerance (UNESCO)
20 November - Africa Industrialization Day
20 November - Universal Children's Day (UNICEF)
21 November - World Television Day
25 November - International Day for the Elimination of Violence against Women
29 November - International Day of Solidarity with the Palestinian People

1 December - World AIDS Day (WHO)
2 December - International Day for the Abolition of Slavery
3 December - International Day of Disabled Persons
5 December - International Volunteer Day for Economic and Social Development
7 December - International Civil Aviation Day (ICAO)
9 December - International Anti-Corruption Day
10 December - Human Rights Day
11 December - International Mountain Day
18 December - International Migrants Day
19 December - United Nations Day for South-South Cooperation

Aviation disasters statistics

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This is an **incomplete listing**. For more exhaustive lists, see the [Aircraft Crash Record Office](https://www.faa.gov) or the [Aviation Safety Network](https://www.thesafetynetwork.org). Airlines seem to be remembered by their worst accidents, and in that sense this list presents a good overview, but it is not complete.
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April 7 - A Daimler Airway de Havilland DH.18A collides with a CGEA operated Farman F.60 Goliath over Picardie, killing 7 people. This is the first midair collision of airliners.
[edit] 1930

- October 5 – The British airship **R101** crashes north of **Paris**, killing 48 people in an eruption of flames.

[edit] 1931

- March 21 – Australian National Airways **Southern Cloud**, a **Avro 618 Ten**, crashes in the **Snowy Mountains** while flying from **Sydney** to **Melbourne**. All 8 on board are killed in Australia's first significant airline disaster. The crash site remains undiscovered for 27 years. Severe weather at the time of the flight is the likely cause of the accident.
- March 31 – **Transcontinental & Western Air Flight 599**, a **Fokker F-10 Trimotor**, crashes near **Cottonwood Falls, Kansas**, killing all eight aboard, including legendary **University of Notre Dame football** coach **Knute Rockne**.

[edit] 1933

- October 10 – A **United Airlines Boeing 247** is destroyed by a bomb over **Chesterton, Indiana** in the **first proven case of air sabotage** on a commercial aircraft; all seven on board are killed.

[edit] 1937

Deutsche Zeppelin Reederei **Hindenburg** bursting into flames

- May 6 – A **Deutsche Zeppelin Reederei** flight, the **Zeppelin Hindenburg**, bursts into flames and crashes while attempting a landing at **Naval Air**
Engineering Station Lakehurst in New Jersey; of the 97 people on board, 35 are killed. One person on the ground also dies.

- November 16 – A Sabena Junkers Ju 52 crashes near Ostend, Belgium killing all 11 on board, including the Grand Duke and Grand Duchess of Hesse.

[edit] 1938

- January 10 – Northwest Airlines Flight 2, a Lockheed L14H Super Electra, crashes near Bozeman, Montana, killing all ten on board; the machine with which the manufacturer measured component vibration is found to be inaccurate, causing the aircraft to be more prone to flutter than thought.

[edit] 1939

- January 13 – Northwest Airlines Flight 1, a Lockheed L14H Super Electra, crashes on takeoff from Miles City, Montana, killing all four on board. The aircraft's cross-feed fuel valve leaked fuel into the cockpit and an intense fire broke out.

[edit] 1940

- June 14 – In the Kaleva incident, an Aero Junkers Ju 52-3/mge flying from Tallinn, Estonia to Helsinki, Finland is shot down by two Soviet bombers over the Gulf of Finland, with all nine aboard killed while Finland is not at war with any country.

[edit] 1941

- February 26 – Eastern Air Lines Flight 21, a DC-3, crashes while descending to land at Atlanta, Georgia, killing 16 of 25 aboard; World War I hero and Eastern Air Lines president Eddie Rickenbacker is among the survivors.
[edit] 1942

- January 16 – *TWA Flight 3*, a DC-3 airplane returning to California refuels and takes off from Las Vegas, and twenty-three minutes later crashes into "Double Up Peak" on a clear night near the 8,300 ft level of Mount Potosi, 30 mi SW of Las Vegas; All 22 passengers are killed including actress Carole Lombard and her mother.

[edit] 1943

- June 1 – *BOAC Flight 777*, a Douglas DC-3, is shot down by Luftwaffe fighter aircraft over the Bay of Biscay, killing 17 passengers and crew, including actor Leslie Howard and leading to speculation that the flight is attacked because German intelligence believe that British Prime Minister Winston Churchill is aboard.

[edit] 1947

- August 12 – A British South American Airways Avro Lancaster named Star Dust disappears over the Andes after transmitting an enigmatic coded message ("STENDEC"); the fate of the plane remain a mystery until the crash site is located in 2000; Four crew and nine passengers are killed.
- October 24 – United Airlines Flight 608, a DC-6, crashes near Bryce Canyon Airport, Utah, when a fire caused by a design flaw destroys the aircraft; All 52 on board die.

[edit] 1948

- January 28 – A flight chartered by the United States Immigration and Naturalization Service crashes in the hills west of Coalinga, California, killing 32. The crash becomes the impetus of the Woody Guthrie song "Deportee."
- March 12 – Northwest Airlines Flight 4422, a DC-4, crashes into Mount Sanford in the Alaska Territory, killing 30.
- **June 17** – **United Airlines** When **Flight 624**, a **DC-6**, crashes near **Mount Carmel, Pennsylvania** after errors in executing procedures to extinguish what is believed to be an on-board fire, all 43 on board die.

- **July 17** – A **Catalina** seaplane named **Miss Macao**, operated by a **Cathay Pacific** subsidiary, with 23 passengers and three crew on board flying from **Macau** to **Hong Kong**, is hijacked midway over the **Pearl River** delta by a group of four hijackers attempting to rob the passengers on board. The pilot is attacked and loses control during the ensuing struggle in the cockpit. The subsequent crash kills all on board except one passenger, who is later identified to be the lead hijacker. This is the first known case of airliner hijack.

- **October 2** – In the **Bukken Bruse disaster**, a **flying boat** crashes upon landing in **Trondheim**. 19 are killed, while **Bertrand Russell** is among the 24 survivors.

- **October 20** – In the **1948 KLM Constellation air disaster**, a **Lockheed Constellation** named **Nijmegen** crashes near **Prestwick, Scotland**, killing 40.

[edit] 1949

- **May 4** – In the **Superga air disaster**, an **Italian Airlines FIAT G212CP** carrying the **Torino football** team (see also **Grande Torino**) crashes into the Superga hills near **Turin**, killing all 31 on board, including 18 players.

- **September 9** – A **Canadian Pacific Airlines Douglas DC-3** **explodes in flight en route** from **Quebec City** to **Baie-Comeau, Quebec** as the result of sabotage, killing all 23 on board.

- **November 1** – **Eastern Air Lines Flight 537**, a **Douglas DC-4**, on approach to **Washington National Airport**, has a **mid-air collision** with a **Lockheed P-38**. All 55 people on board the DC-4 die, including Congressman **George J. Bates**, **New Yorker** cartoonist **Helen Hokinson**, and former Congressman **Michael J. Kennedy** while the pilot and sole occupant of the P-38 is seriously injured.
November 29 – American Airlines **Flight 157**, a Douglas DC-6 en route from New York City to Mexico City, veers off the runway and strikes buildings after the flight crew loses control of the aircraft during its final approach to Dallas Love Field. 26 passengers and 2 flight attendants die.

**[edit] 1950**

- June 24 – Northwest Orient Airlines **Flight 2501**, a Douglas DC-4 with 58 people on board, disappears without a trace over Lake Michigan.
- August 31 – TWA **Flight 903**, a Lockheed L749A Constellation, crashes in the desert about 65 miles NNW of Cairo, Egypt, while returning due to an engine fire. All 55 on board are killed.

**[edit] 1951**

- April 25 – Cubana de Aviación **Flight 493**, a Douglas DC-4 en route from Miami, Florida to Havana, Cuba, collides in mid-air with a United States Navy Beech SNB-1 Kansan off Key West. All 43 aboard both aircraft are killed.
- June 22 – Pan Am **Flight 151**, a Lockheed L049 Constellation en route from Accra, Ghana to Monrovia, Liberia, crashes into a hill near a village called Sanoye in Bong County in Liberia, 54 miles (86km) from the airport. All 31 passengers and nine crew members die.

**[edit] 1952**

- April 28 – Pan Am **Flight 202**, a Boeing 377 Stratocruiser, crashes in a remote area of Brazil on its way from Buenos Aires, Argentina to New York City via Rio de Janeiro, Brazil after a propeller fails and causes damage to various control surfaces. All 50 on board are killed.

**[edit] 1953**

- October 29 – British Commonwealth Pacific Airlines **Flight 304**, a DC-6, crashes into King's Mountain, southeast of Half Moon Bay, California, on its
approach to the San Francisco International Airport. The accident kills all 11 passengers, including American pianist William Kapell, and the crew of eight.

[edit] 1954

- **January 10** – BOAC Flight 781, a de Havilland Comet flying from Rome to London on the last leg of a flight from Singapore, disintegrates in midair, killing all 29 passengers and six crew members. The accident is eventually attributed to metal fatigue from repeated pressurization and depressurization flexing the fuselage.
- **April 8** – South African Airways Flight 201, a de Havilland Comet flying from Rome to Cairo bound for Johannesburg, disintegrates in midair, killing all 14 passengers and seven crew members. The cause of the disaster is determined to be the same metal fatigue problem that brought down BOAC Flight 781 on January 10 of the same year.
- **September 5** – KLM Flight 633, a Lockheed L1049 Super Constellation, ditches after takeoff from Shannon Airport in Ireland, killing 28 of 56 on board.

[edit] 1955

- **February 19** – TWA Flight 260, a Martin 404, crashes into the Sandia Mountains near Albuquerque, New Mexico, killing all 16 on board.
- **April 11** – An Air India aircraft named Kashmir Princess is bombed under suspicious circumstances. 16 people are killed and three survive.
- **July 27** – El Al Flight 402, a Lockheed L-049 Constellation, inadvertently strays over Bulgarian territory on its way from Vienna to Tel Aviv, and is shot down by 2 Bulgarian fighter aircraft, killing all 58 on board.
- **October 6** – United Airlines Flight 409 crashes near Centennial, Wyoming, killing all 66 onboard.
- **November 1** – United Airlines Flight 629 is bombed by Jack Gilbert Graham over Denver, Colorado. All 44 on board are killed.
1956

- April 2 – Northwest Orient Airlines Flight 2, a Boeing Stratocruiser, ditches into Puget Sound after takeoff from Seattle-Tacoma International Airport after the cowl flaps are incorrectly set for takeoff. Four passengers and one flight attendant die, likely of hypothermia while waiting for rescue, while 33 survive.

- June 30 – United Airlines Flight 718, a DC-7 flying from Los Angeles to Chicago, and TWA Flight 2, a Lockheed Constellation flying from Los Angeles to Kansas City, collide over the Grand Canyon, killing all 128 people on board both planes. The pilots of both planes had requested to fly into the Grand Canyon's airspace to view the canyon, but did not see each other. This crash leads United States President Eisenhower to order the creation of the Federal Aviation Administration in 1957 in order to help provide safe separation of aircraft using radar.

- July 9 – A Trans-Canada Air Lines Vickers Viscount sheds a propeller blade over Flat Rock, Michigan. The blade enters the passenger cabin, killing one. All other 34 has survived. This is the first known incident in which a turboprop engine sheds a propeller in passenger service.

- October 16 - Pan Am Flight 6 a Boeing 377 Stratocruiser is forced to ditch in the Pacific Ocean between Hawaii and San Francisco near a Coast Guard ship. All 31 onboard were rescued.

- December 9 – Trans-Canada Air Lines Flight 810, a Canadair Northstar, crashes near Hope, British Columbia, Canada, killing all 62 people on board. The wreckage is not located until almost a year later.

1957

- February 1 – Northeast Airlines Flight 823, a DC-6, crashes during a snowstorm shortly after takeoff from LaGuardia Airport. Twenty of the 101 occupants die.
November 8 - Pan Am Flight 7, a Boeing 377 Stratocruiser vanishes between San Francisco and Honolulu. Small pieces of wreckage and human remains are found almost a week later by the Navy. All 44 onboard are believed to have been killed. Carbon monoxide poisoning is suspected of causing the crash, but not proven.

[edit] 1958

February 6 – British European Airways Flight 609, an Airspeed Ambassador, crashes during takeoff from Munich-Riem airport, killing 23 of 44, including eight Manchester United footballers.

April 6 – Capital Airlines Flight 67, a Vickers Aircraft 745D Viscount, crashes at Tri-City Airport (now MBS International Airport) near Freeland, Michigan, killing all 47 passengers and crew. An undiscovered ice buildup on the wing and windy conditions were possible causes.

August 14 – KLM Flight 607-E, a Lockheed L1049 Super Connie en route from Brussels, Belgium to New York, crashes into the Atlantic Ocean shortly after takeoff from Shannon Airport in Ireland, killing all 99 passengers and crew, including six members of the Egyptian fencing team; the cause is undetermined but is thought to be an overspeeding propeller.

[edit] 1959

February 3 – American Airlines Flight 320, a Lockheed L-188 Super Electra, crashes into the East River, New York City, due to pilot error. Sixty five passengers and crew are killed.

October 30 – Piedmont Airlines Flight 349, a Douglas DC-3, crashes on Bucks Elbow Mountain near Charlottesville, Virginia, killing the crew of three and 23 of 24 passengers. The sole survivor is seriously injured. The cause is a navigational error during an ILS approach.
**November 16** – National Airlines **Flight 967**, a Douglas DC-7B, crashes into the Gulf of Mexico while on a flight from Tampa, Florida to New Orleans, Louisiana. The cause is reported to be a bomb. All 40 on board perish.

[edit] **1960**

- **January 6** – National Airlines **Flight 2511**, a Douglas DC6B bound from New York to Miami crashes near Bolivia, North Carolina, killing all 34 people on board when a bomb planted on board explodes in mid-air.
- **March 17** – Northwest Orient Airlines **Flight 710**, a Lockheed L188 Super Electra en route from Chicago, Illinois to Miami, Florida, breaks apart at 15,000 feet and crashes near Tell City, Indiana, killing all 63 on board.
- **October 4** – Eastern Air Lines **Flight 375**, a Lockheed L188 Super Electra, crashes on takeoff from Boston's Logan International Airport after a bird strike (a flock of starlings), damaging the engines, clogging the Pitot tubes, and obstructing the pilot's view. The aircraft crashes into Winthrop Bay; 62 of 72 aboard die.
- **December 16** – The **1960 New York air disaster**: United Airlines Flight 826, a DC-8, and TWA Flight 266, a Super Constellation, suffer a mid-air collision over Staten Island in New York, killing all 128 aboard the two planes and six people on the ground.

[edit] **1961**

- **January 3** – Aero **Flight 311**, a Douglas DC-3, crashes into woods near Koivulahti, Finland, killing all 25 on board.
- **February 15** – Sabena **Flight 548**, a Boeing 707, crashes on approach in Brussels, Belgium, killing 73, including the entire United States figure skating team: a runaway stabilizer is thought to be the cause of the first fatal accident involving a 707 in regular passenger service.
September 17 – Northwest Orient Airlines Flight 706, a Lockheed L-188 Electra, crashes on takeoff from Chicago, killing 37 when a maintenance error causes the ailerons to become detached from the control wheels.

November 23 - Aerolineas Argentinas, a Comet 4, crashes on takeoff from Campinas, Brazil, killing all 52 people on board.

1962

March 1 – American Airlines Flight 1, a Boeing 707, crashes in Jamaica Bay, Queens, New York, killing 95.

March 4 – Caledonian Airways Flight 153, a DC-7, crashes into a jungle swamp at Douala, Cameroon, killing 111.

March 16 – Flying Tiger Line Flight 739, a Lockheed L1049 Super Connie chartered by the United States military, disappears over the western Pacific carrying 96 American soldiers en route to South Vietnam.

May 22 – Continental Airlines Flight 11, a Boeing 707, breaks up in mid-air after a passenger's bomb explodes in the right rear lavatory while the flight is near Unionville, Missouri, killing all 45 on board.

June 3 – Air France Charter Flight Chateau de Sully, a Boeing 707, skids and burns after the pilot aborts takeoff at Orly Airport, killing many of Atlanta, Georgia's civil and cultural leaders; two flight attendants are the only survivors as 130 die in the worst one-aircraft accident to the date.

November 8 - A Finnair DC-3 crashes on Mariehamn, Åland; 22 of 24 on board perish.

November 23 – United Airlines Flight 297, a Vickers Aircraft 745D Viscount, crashes near Ellicott City, Maryland after a bird strike, killing all 17 people on board.

November 30 – Eastern Air Lines Flight 512, a Douglas DC-7B, crashes due to pilot error on missed approach into New York's Idlewild airport, killing 25 of 51 on board.
1963

- **July 3** – Mohawk Airlines **Flight 121**, a Martin 404, crashes near Rochester, New York while attempting takeoff, killing seven of the 43 people on board.
- **August 21** – An Aeroflot Tupolev Tu-124 ditches in the Neva river in Leningrad after engine failure. There are no fatalities from 52 on board, but the aircraft is destroyed.
- **November 29** – Trans-Canada Air Lines **Flight 831**, a DC-8, crashes shortly after takeoff from Montréal/Dorval Airport, killing all 118 people on board.
- **December 8** – Pan Am **Flight 214**, a Boeing 707, is struck by positive lightning and crashes near Elkton, Maryland, killing all 81 people on board.

1964

- **May 7** – Pacific Air Lines **Flight 773**, a Fairchild F27, crashes near San Ramon, California after a passenger shoots both the captain and first officer before turning the gun on himself, killing all 44 aboard.
- **November 15** – Bonanza Air Lines **Flight 114**, a Fairchild F27, crashes into a mountain in poor weather while on a nighttime approach to Las Vegas, Nevada. All 29 aboard perish when the plane impacts only 10 feet (3 m) below a ridge. Initially blamed on a pilot’s misreading his approach chart, years later the chart maker agrees to pay a settlement of US$490,000 to some of the victims' heirs after it is shown the chart had incorrect markings.
- **November 20** – Linjeflyg **Flight 277**, a Convair CV-340, crashes during the approach to Engelholm, Sweden, when in instrument meteorological conditions the crew abandons the set procedure and begins the landing too soon. 31 people are killed and 12 survived.
- **December 24** – Flying Tiger Line **Flight 282**, a Lockheed Constellation, crashes near San Bruno, California after an unexplained course deviation, killing the crew of 3.
[edit] 1965

- **February 8** – Eastern Air Lines **Flight 663**, a Douglas DC-7B on takeoff, overreacts in avoiding Pan Am Flight 212 (a Boeing 707) on approach, loses control, and crashes into Jones Beach State Park, New York, killing all 84 on board.

- **May 20** – Pakistan International Airlines **Flight 705**, a Boeing 720, crashes on descent to Cairo International Airport, killing 119.

- **July 1** - Continental Airlines **Flight 12**, a Boeing 707, runs off the end of the runway at Kansas City Downtown Airport breaking into 3 pieces. All 66 onboard survive.

- **November 11** - When United Airlines **Flight 227**, a Boeing 727, crashes short of the runway while attempting a scheduled landing at Salt Lake City International Airport, Salt Lake City, Utah, 43 of 91 aboard are killed.

[edit] 1966

- **February 4** – When ANA **Flight 60**, a Boeing 727-100, crashes into Tokyo Bay, Japan all 133 aboard are killed, most returning from the Sapporo Snow Festival.

- **March 5** – The Japanese Ministry of Transport blames turbulence when BOAC **Flight 911**, a Boeing 707, bound for Hong Kong, crashes at Mount Fuji near Gotenba, Japan killing all 124 passengers and crew.

- **August 6** – All 42 on board are killed when Braniff **Flight 250**, a BAC One-Eleven, flies into an active squall line and breaks apart in midair near Falls City, Nebraska.

- **November 13** – ANA **Flight 533**, a NAMC YS-11, plunges into Seto Inland Sea after an overrun at Matsuyama Airport, Shikoku, Japan, killing all 50 passengers (mostly newlyweds) and crew.

- **November 15** – Pan Am **Flight 708**, a Boeing 727, crashes near Berlin, Germany. All three crew members are killed.
1967

- **March 9** – TWA **Flight 553** a Douglas DC-9 collides with a Beechcraft Baron near Dayton, Ohio, killing all 26 on both planes.

- **June 4** – In the **Stockport air disaster**, a British Midland Canadair C4 Argonaut carrying passengers returning from Palma de Mallorca is on approach to Manchester Airport when an engine loses power due to a design failure in the aircraft's fuel system. 72 of 84 on board are killed.

- **June 23** – Mohawk Airlines **Flight 40**, a BAC One-Eleven, crashes in Blossburg, Pennsylvania, killing all 34 people on board.

- **July 19** – Piedmont Airlines **Flight 22**, a Boeing 727 departing from Asheville, North Carolina, crashes shortly after departure after a mid-air collision with a twin-engine Cessna 310 on instrument approach to Asheville. All 82 passengers and crew on both aircraft die.

- **November 20** – TWA **Flight 128**, a Convair 880, crashes in Constance, Kentucky on approach to Greater Cincinnati Airport, killing 70 out of 82 persons on board.

1968

- **March 24** – Aer Lingus **Flight 712**, a Vickers 803 Viscount, crashes off the Irish coast. All 61 on board perish.

- **April 8** - BOAC Zulu Whisky, a Boeing 707 taking off from London Heathrow bound for Sydney.

- **May 3** – Braniff **Flight 352**, a Lockheed L188A Super Electra en route from Houston, Texas to Dallas, crashes in a thunderstorm, killing its 5 crew and 80 passengers.

- **July 1** – Seaboard World Airlines **Flight 253**, a Douglas DC-8, is forced to land in the Soviet Union. On board are over 200 American troops bound for Vietnam.

- **September 11** – Air France **Flight 1611**, a Caravelle, crashes off Nice, France, killing 95 passengers and crew.

[edit] **1969**

- **January 18** - [United Airlines Flight 266](#) a Boeing 727-22C en route from Los Angeles, CA to Milwaukee, WI via Denver, CO loses all electrical power and crashes into Santa Monica Bay. The crew of six, and 32 passengers are killed.
- **February 18** – [Hawthorne Nevada Airlines Flight 708](#), a [Douglas DC-3](#), crashes near Lone Pine, California, killing all 35 people on board.
- **September 9** – [Allegheny Airlines Flight 853](#), a DC-9, collides in flight with a [Piper PA-28](#) and crashes near Fairland, Indiana, killing all 83 occupants aboard the two aircraft.
- **November 19** – [Mohawk Airlines Flight 411](#), a [Fairchild 227](#), crashes near Glens Falls, New York, killing all 14 people on board.

[edit] **1970**

- **February 15** – Contaminated fuel causes dual engine failure shortly after takeoff from [Las Américas International Airport](#) near Santo Domingo, Dominican Republic in the [Dominicana DC-9 air disaster](#). All 102 on board were killed.
- **February 21** – A bomb in the cargo hold of [Swissair Flight 330](#), a Convair CV-990, detonates 9 minutes after takeoff from Zürich International Airport in Kloten, Switzerland. All 38 passengers and 9 crew members perished.
- **March 31** – [Japan Airlines Flight 351](#), a Boeing 727, is hijacked to North Korea by a [Japanese Red Army](#) faction.
- **May 2** – [ALM Flight 980](#), a [Douglas DC-9](#) operated by [Overseas National Airways](#), ditches near St. Croix, Virgin Islands, killing 23 including 2 infants and 1 crew member; 40 including 4 crew members survive.
- **July 5** – [Air Canada Flight 621](#), a Douglas DC-8, explodes following a failed landing at [Toronto Pearson International Airport](#), with 109 fatalities.
August 9 – **LANSA Flight 502**, a Lockheed Electra turboprop, crashes and burns shortly after takeoff from **Cuzco, Peru**, killing 99 people on the plane and 2 on the ground; among the dead are 49 American high school exchange students.

August 12 – **China Airlines Flight 206**, a NAMC YS-11, crashes in thick fog and a severe thunderstorm into Yuan Mountain, near **Taipei Airport**, killing 14 out of 31 people on board.

September 6 – The **Popular Front for the Liberation of Palestine** orchestrate the **Dawson's Field hijackings** of **El Al** Flight 219, **Pan Am** Flight 93, **Swissair** Flight 100, **TWA** Flight 741, and (on **September 9**) **BOAC** Flight 775. The unprecedented scale of the incident draws international outrage and plays a major role in instigating the eventual widespread implementation of **air passenger screening**, heretofore done only haphazardly and inconsistently.

November 14 – **Southern Airways Flight 932**, a chartered **Douglas DC-9-31**, crashes on approach at **Tri-State/Milton Ferguson Airport** in **Huntington, West Virginia**, en route from **Kinston, North Carolina**, killing all 75 on board. The dead include the entire coaching staff and 37 members of the **Marshall University football** team. (See also **We Are Marshall**, a 2006 film about the aftermath of the crash.) The aircraft descended too low without visual contact with the runway, despite the absence of an **ILS** glide slope system at the airport.

[edit] 1971

June 6 – Following a **mid-air collision** with a **United States Marine Corps F-4B Phantom II** jet fighter, **Hughes Airwest Flight 706**, a **DC-9**, crashes into the **San Gabriel Mountains** near **Duarte, California**, killing all 49 people aboard. The pilot of the Phantom also dies. The radar intercept officer on the Phantom successfully bails out.
• **July 3** – TDA(Toa Domestic Airlines) **Flight 64**, a NAMC YS-11, hits Mount **Yokotsu** near **Hakodate Airport**, **Hokkaidō**, **Japan**, killing all 68 passengers and crew.

• **July 30** – ANA **Flight 58**, a **Boeing 727-200**, collides with a JSDF F-86 fighter jet at **Shizukuishi** near **Morioka**, **Japan**, killing all 162 passengers and crew; the JSDF pilot parachutes to safety, and is later arrested by local police on suspicion of colliding with a civilian aircraft.

• **November 24** – A man using the name **Dan Cooper** hijacks **Northwest Orient Airlines Flight 305**, a **Boeing 727**, out of **Portland, Oregon**. He releases the passengers in exchange for US$200,000 and four **parachutes**. The crew takes off with Cooper on board, and he parachutes from the plane. Cooper is never found, although a roll of bills from his ransom is found in a riverbed many years later.

• **December 24** – **LANSA Flight 508**, a **Lockheed Electra** en route from **Lima** to **Pucallpa, Peru**, breaks apart in mid-air after being set afame by lightning. It crashes in the **Amazon Rainforest** and 91 people die; the sole survivor is **Juliane Koepcke**, a 17-year old girl who survives a fall from 2 miles and a 10-day walk through the jungle before being found by hunters. Her mother, famous ornithologist **Maria Koepcke**, dies; director **Werner Herzog** had narrowly missed being on the same flight.

[edit] **1972**

• **January 26** – JAT Yugoslav **Flight 364**, a DC-9, suffers a **bomb** explosion while en route from **Copenhagen** to **Zagreb**. 27 of 28 on board are killed. The **only survivor** is entered in the **Guinness Book of World Records** for surviving the longest fall without a parachute, over ten thousand meters.

• **March 3** – Mohawk Airlines **Flight 405**, a **Fairchild FH227B** twin-engine **turboprop**, crashes near **Albany, New York** while descending to land, killing 16 of the 48 people on board and 1 on the ground.
May 30 – Delta Air Lines Flight 9570, a Douglas DC-9, crashes at Greater Southwest International Airport due to wake turbulence from a leading DC-10. All 4 on board perished.

June 12 – American Airlines Flight 96, a DC-10, suffers explosive decompression when one of its cargo doors fails in flight. The crew manages an emergency landing at Detroit, Michigan, and all 67 on board evacuate safely.

June 15 – Cathay Pacific Flight 700Z, a Convair CV-880, suffers an in-cabin suitcase bomb explosion at an altitude of 29,000 feet over Vietnam. All 81 on board perished.

June 18 – British European Airways Flight 548 encounters a series of stalls followed by a deep stall due to pilot error and crashes near Staines, United Kingdom. All 118 on board are killed.

June 24 – Prinair Flight 191 is over-rotated due to pilot error and crashes in Ponce, Puerto Rico, killing five of 20 people on board.

October 13 – Uruguayan Air Force Flight 571 crashes in the Andes mountains, killing 29 of 45 people on board. See also Alive: The Miracle of the Andes.

December 8 – United Airlines Flight 553 crashes after a second landing attempt at Chicago Midway International Airport, killing 43 of 60 people on board and two people on the ground. Among those killed was Watergate conspirator E. Howard Hunt's wife Dorothy Hunt.

December 23 – Braathens Flight 239 crashes in Asker upon landing at Fornebu airport, Oslo, Norway, killing 40 of 45 people on board. The aircraft was four nautical miles off course in bad weather conditions, possibly due to pilot error.

December 29 – Eastern Air Lines Flight 401, a Lockheed L-1011, crashes in the Florida Everglades, killing 103 of 176 people on board. The crew is distracted by a faulty gear-down light, resulting in controlled flight into terrain. This is the first crash of a widebody aircraft.
**1973**

- **February 21** – Libyan Arab Airlines Flight 114, a Boeing 727, flies off course and is shot down by Israeli jets in the Sinai war zone, killing 108 of 113 people on board.
- **July 11** – Varig Flight 820, a Boeing 707, experiences an on-board fire and crashes near Paris, France, killing 123 out of 134 on board.
- **July 23** – Japan Air Lines Flight 404, a Boeing 747, is hijacked after takeoff from Amsterdam Schiphol Airport in the Netherlands. One of the terrorists is killed (and the flight's purser injured) by a grenade blast during the hijacking. After several days and multiple flight legs, the passengers are released in Benghazi, Libya; the aircraft is then blown up on the ground.
- **December 17** – Pan Am Flight 110, a Boeing 707, is firebombed by Palestinian militants while at gate in Rome, Italy. 29 of 68 passengers and crew are killed. The militants then hijack a Lufthansa Boeing 737 to Athens. In total, 33 die as a result of the firebombing and hijacking.

**1974**

- **March 3** – Turkish Airlines Flight 981, a DC-10, crashes in the Ermenonville forest near Senlis, France after the rear underfloor cargo door opens during flight; all 346 on board die.
- **September 8** – TWA Flight 841 is destroyed by a bomb in the cargo hold and plunged into the Ionian Sea; all 88 on board are killed.
- **September 11** – Eastern Air Lines Flight 212, a DC-9, crashes on approach to Charlotte, North Carolina; 72 of 82 people on board are killed.
- **September 15** – Air Vietnam Flight 706 is hijacked and crashes in Phan Rang, Vietnam; all 75 on board die.
- **November 20** – Lufthansa Flight 540 crashes shortly after takeoff in Nairobi, Kenya; 59 of 157 on board are killed. This is the first crash of a Boeing 747.
• **December 1** – TWA **Flight 514**, a Boeing 727 in-bound to Dulles International Airport, crashes into Mount Weather in Bluemont, Virginia, killing all 85 passengers and seven crew.

[edit] **1975**

• **June 24** – Eastern Air Lines **Flight 66**, a Boeing 727, encounters wind shear on final approach and strikes approach lights at John F. Kennedy International Airport, killing 112 of 124 people on board.

• **September 30** – Malév **Flight 240**, a Tupolev Tu-154, is shot down near Lebanon, killing all 60 people on board.

[edit] **1976**

• **January 1** – Middle East Airlines **Flight 438**, a Boeing 720, crashes in Saudi Arabia when a bomb explodes in the forward baggage compartment, killing all 81 people on board.

• **April 27** – American Airlines **Flight 625**, a Boeing 727, crashes on approach to St. Thomas, Virgin Islands, killing 37 of 88 people on board.

• **June 27** – Air France **Flight 139**, an Airbus A300, is hijacked from Athens by two Palestinians and two Germans who divert the flight to Libya and then to Uganda, where the plane is met by pro-Palestinian forces from Idi Amin's government. Israeli troops eventually storm the airport in Operation Entebbe, killing hijackers and Ugandan soldiers and freeing all but three of the hostages. Israeli colonel Yonatan Netanyahu, brother of Benjamin Netanyahu, is also killed in the raid.

• **July 28** – ČSA **Flight OK-NAB**, an Ilyushin Il-18, crashes near Bratislava in Czechoslovakia, killing 76 of 78 people on board.

• **September 10** – A **mid-air collision** occurs between a British Airways Trident and an Inex-Adria DC-9 near Zagreb, Yugoslavia, killing all 176 people on board both aircraft.
October 6 – Cubana Flight 455, a Douglas DC-8, is bombed by anti-Castro terrorists and crashes near Bridgetown, Barbados, killing all 73 people on board.

[edit] 1977

January 15 – A Skyline Sweden Vickers Viscount 838 crashes in Kälvesta, Sweden just outside Stockholm, killing all 22 on board.

March 27 – KLM Flight 4805 and Pan Am Flight 1736, both Boeing 747s, collide in the Tenerife disaster. This accident, the worst in the history of commercial aviation, kills 583 of 644 people on board both aircraft.

April 4 – Southern Airways Flight 242, a DC-9, crash-lands on a highway near New Hope, Georgia after dual engine failure encountered in a thunderstorm. 62 out of 85 aboard are killed, along with eight people on the ground.

April 28 – An Aviateca Convair 240 crashes near Guatemala City, Guatemala, killing all 28 people on board.

May 14 – A Dan-Air/IAS Cargo Boeing 707 crashes near Lusaka, Zambia, killing all 6 on-board.

May 27 – An Aeroflot Ilyushin Il-62 crashes on approach in Havana, Cuba. It remains the second-worst air accident in Cuba's history.

September 28 – Japan Air Lines Flight 472, a Douglas DC-8, is hijacked after taking off from Mumbai, India by Japanese Red Army (JRA) terrorists. The terrorists force the plane to land in Dhaka, Bangladesh, where they demand US$6,000,000 and the release of nine imprisoned JRA members being held in Japan. The Japanese government complies and all of the hostages are eventually released.

October 13 – Lufthansa Flight 181, a Boeing 737, is hijacked by four Palestinian members of the PFLP. The hijackers kill the captain; subsequently, German police commandos from GSG 9 storm the aircraft,
killing three of the hijackers and capturing the fourth, with no other casualties.

- **October 20** – **Lynyrd Skynyrd**'s chartered **Convair 240** airliner runs out of fuel en route to **Baton Rouge, Louisiana**, crashing five miles north of **Gillsburg, Mississippi** in a swampy pine forest while trying to reach an alternate airport. Four members of the band and crew are killed, as are both pilots. Lead singer and founder of the band, **Ronnie Van Zant**, dies at the crash site.

- **November 19** - **TAP Portugal Flight 425**, a **Boeing 727** overran the runway at **Madeira Airport** and plunged over a steep bank, bursting into flames, killing 131 of the 164 people on board.

- **December 4** – **Malaysia Airlines Flight 653**, a **Boeing 737**, is hijacked under mysterious circumstances; minutes later, the airliner crashes into a swamp near **Tanjung Kupang, Malaysia** at a steep angle, killing all 100 people aboard.

[edit] **1978**

- **January 1** – **Air-India Flight 855**, a **Boeing 747**, crashes into the **Arabian Sea** due to instrument malfunction and pilot error. All 213 passengers and crew die.

- **April 20** – **Korean Air Lines Flight 902**, a **Boeing 707**, is shot down by Soviet fighter planes. The plane crash-lands near the **Soviet Union**'s border with **Finland**; two of the 109 people on board are killed. The rest are subsequently released.

- **May 8** – **National Airlines Flight 193**, a **Boeing 727**, lands short on approach to **Pensacola, Florida** in **Escambia Bay** due to pilot error. Three passengers out of 58 people on board drown.

- **June 26** – **Air Canada Flight 189**, a **DC-9**, crashes on takeoff in **Toronto, Ontario** due to tire failure. Two die out of 107 passengers on board.
• **September 25** – Pacific Southwest Airlines **Flight 182**, a Boeing 727, collides with a Cessna 172 over San Diego, California. All 135 aboard the airliner, both pilots of the Cessna, and seven people on the ground are killed; the worst aviation disaster in California history.

• **November 15** – Icelandic Airlines **Flight LL 001**, a DC-8 on a charter flight, crashes into a coconut plantation while on approach to Katunayake, Sri Lanka for a refueling stop. 184 out of 264 people on board are killed.

• **December 28** – United Airlines **Flight 173**, a DC-8, runs out of fuel while circling near Portland, Oregon in order for the crew to investigate a light indicating a problem with the landing gear. The plane crashes in a wooded area, killing 10 and injuring 24 of the 181 on board.

[edit] **1979**

• **May 25** – American Airlines **Flight 191**, a DC-10, crashes on takeoff from O'Hare International Airport after catastrophic mechanical failure, killing all 271 on board and two on the ground. Prior to the September 11, 2001 attacks, this was the worst airliner incident in American history, and it remains the worst single-aircraft airliner accident on US soil.

• **October 31** – Western Airlines **Flight 2605**, a McDonnell-Douglas DC-10, strikes a vehicle on a closed runway in dense fog at Mexico City, Mexico. 72 die.

• **November 26** – Pakistan International Airlines **Flight 740**, a Boeing 707, crashes after a fire in the cabin in Jeddah, Saudi Arabia. All 145 passengers and 11 crew die.

• **November 28** – Air New Zealand **Flight 901**, a DC-10, hits high ground on Mount Erebus, Antarctica, during a sightseeing flight, killing all 257 people on board. This is also known as the Mount Erebus disaster.
**[edit] 1980**

- **March 14** - LOT Polish Airlines **Flight 007**, an Ilyushin Il-62 crashes near Warsaw airport due to loss of control after the no. 2 engine disintegrates and severs the elevator and rudder control lines. All 87 on board perish.
- **June 27** – Aerolinee Itavia **Flight 870** crashes into the sea near Italy in controversial circumstances, killing all 81 people on board.
- **August 19** – Saudia **Flight 163** lands at King Khalid International Airport in Riyadh, Saudi Arabia when a fire breaks out on board. The evacuation of the plane upon landing is delayed and all 301 on board die.

**[edit] 1981**

- **August 22** – Far Eastern Air Transport **Flight 103**, a Boeing 737, disintegrates during flight and crashes near Taipei, Taiwan. Severe corrosion in the fuselage structure leads to explosive decompression and disintegration at high altitude; all 110 on board are killed.
- **October 6** – NLM Cityhopper **Flight 431** is destroyed by a tornado near Rotterdam, killing all 17 people on board.
- **December 1** – Inex-Adria McDonnell Douglas MD-81 crashes in the mountains while approaching Campo dell'Oro Airport in Ajaccio, Corsica, killing all 180 on board.

**[edit] 1982**

- **January 13** – Air Florida **Flight 90**, a Boeing 737, crashes into the frozen Potomac River after takeoff from Washington National Airport. Five on board survive; 78 on board and 4 on the ground die, including one initial survivor who dies after ensuring that the other crash survivors are rescued from the frozen river.
- **January 23** – World Airways **Flight 30**, a DC-10, overshoots the runway at Boston, Massachusetts. Two passengers are ejected from the aircraft; their bodies are never found.
- June 8 – VASP Flight 168, a Boeing 727, crashes into a hillside in Brazil, killing all 137 on board.
- June 23 – British Airways Flight 009, a Boeing 747-200, flies through a cloud of volcanic ash south of Java; all engines fail in flight, forcing the plane to glide. The crew is able to restart the engines and make a safe landing.
- July 9 – Pan Am Flight 759, crashes in Kenner, Louisiana, shortly after takeoff. All 145 on board and 8 people on the ground are killed.

[edit] 1983

- June 2 – Air Canada Flight 797, a DC-9, catches fire during flight over Kentucky. 23 out of 46 passengers die from smoke inhalation even after the crew successfully land the aircraft in Cincinnati, Ohio. Renowned Canadian folk singer Stan Rogers dies while helping other passengers evacuate the aircraft.
- July 16 – A British Airways Sikorsky S-61 helicopter crashes into the sea off the Isles of Scilly. 20 of 26 people on board die, making the incident the worst helicopter accident in the United Kingdom at the time and sparking a review of helicopter safety.
- July 23 – Air Canada Flight 143, a Boeing 767, runs out of fuel above Manitoba due to a miscalculation. The crew successfully glide the aircraft to a safe landing at a former Air Force base at Gimli, Manitoba. The aircraft became known as the Gimli Glider.
- September 1 – Korean Air Lines Flight 007, a Boeing 747, is shot down by Soviet fighter planes near Sakhalin after violating Soviet airspace. All 269 people on board are killed.
- September 23 – Gulf Air Flight 771, a Boeing 737, crashes near Mina Jebel Ali in the United Arab Emirates after a bomb planted by the Abu Nidal Organization detonates on board. All 117 people on board perish.
• November 27 – Avianca Flight 11, a Boeing 747, strikes a hill while attempting to land at Madrid, Spain, due to a navigational error. Of the 192 passengers and crew aboard, 11 survive.

1984

• March 22 – Pacific Western Airlines Flight 501, a Boeing 737, suffers a catastrophic mechanical failure during takeoff from Calgary. All passengers and crew are safely evacuated, but the plane burns to the ground.

1985

• January 1 – Eastern Air Lines Flight 980, a Boeing 727, impacts Mount Illimani in Bolivia. All 29 people on board are killed.
• January 21 – Galaxy Airlines Flight 203, a Lockheed L-188 Electra, crashes in Reno, Nevada while attempting to return to the airport to troubleshoot a noise, killing 70 of the 71 people on board. It is later discovered that the air start door was not properly secured.
• February 19 – China Airlines Flight 006, a Boeing 747SP, suffers an engine flameout off the coast of California and dives 30,000 feet before regaining control and landing safely in San Francisco.
• June 14 – TWA Flight 847, a Boeing 727, is hijacked by Lebanese militants. One passenger is murdered during the three-day ordeal.
• June 23 – Air-India Flight 182, a Boeing 747, is bombed by Sikh extremists. It crashes into the ocean near Ireland, killing all 329 people on board.
• August 2 – Delta Air Lines Flight 191, a Lockheed Tristar, crashes on approach to Dallas-Fort Worth International Airport due to wind shear from a sudden thunderstorm. Of the 163 passengers and crew aboard, 29 survive.
• August 12 – Japan Air Lines Flight 123, a Boeing 747, crashes into Mount Osutaka after catastrophic failure of the tailplane severs all hydraulic lines and renders the aircraft uncontrollable. 520 of 524 people on board are killed. To date, it is the worst single-aircraft disaster in history.
August 22 – British Airtours Flight 28M, a Boeing 737, aborts its takeoff from Manchester, England due to an engine fire. While 63 passengers and crew escape alive, 53 are killed, most from smoke inhalation.

August 25 - Bar Harbor Airlines Flight 1808 crashes near Auburn, Maine killing all 8 people on board, including Samantha Smith and her father.

September 6 – Midwest Express Airlines Flight 105, a DC-9, crashes after takeoff from Milwaukee, Wisconsin due to engine failure and pilot error. All 31 people on board are killed.

November 23 – EgyptAir Flight 648, a Boeing 737, is hijacked by Palestinian militants. Egyptian special forces storm the plane on the island of Malta. The incident kills 58 out of 90 passengers and all but one of the hijackers.

December 12 – Arrow Air Flight 1285, a DC-8, crashes after takeoff in Gander, Newfoundland, killing all 256 passengers and crew on board, making it currently the worst air disaster to occur in Canada; the cause is determined to be a stall most likely due to wing icing.

[edit] 1986

March 31 – Mexicana Flight 940, a Boeing 727, crashes into high ground near Maravatio, Mexico. All 167 passengers and crew are killed.

April 2 – TWA Flight 840, a Boeing 727, is bombed by Palestinian militants, killing four out of 121 people on board. The plane manages to land safely in Athens.

August 31 – Aeroméxico Flight 498, a DC-9, collides with a Piper Cherokee over Los Angeles, killing all 67 people aboard both aircraft and 15 people on the ground.

September 5 – Pan Am Flight 73, a Boeing 747, is hijacked on the ground at Jinnah International Airport in Karachi, Pakistan, by Palestinian militants. About twenty passengers and crew out of 379 on board die during a shootout inside the plane.
December 25 – Iraqi Airways Flight 163, a Boeing 737, is hijacked by Hezbollah militants while en route to Amman, Jordan. A shootout with security forces causes the plane to crash, killing 63 of the 106 people on board.

[edit] 1987

May 9, 1987 - LOT Polish Airlines Flight 5055, an Il-62M crashes near Warsaw while trying to land due to engines failure. All 183 passengers and crew members perish.

August 16 – Northwest Airlines Flight 255, an MD-82, crashes on takeoff from Detroit Metropolitan Wayne County Airport in Romulus, Michigan, 25 miles west of Detroit, due to pilot error. Out of 155 on board, one four-year-old girl survives.

August 31 – Thai Airways Flight 365, a Boeing 737, crashes into the ocean off the coast of Thailand due to pilot error. All 83 passengers and crew perish.

November 28 – South African Airways Flight 295, a Boeing 747, crashes into the Indian Ocean after a fire in the cargo hold. All 159 aboard die.

November 29 – Korean Air Flight 858, a Boeing 707, crashes into the Andaman Sea after a bomb explodes on board. All 115 people on board are killed.

December 7 – Pacific Southwest Airlines Flight 1771, a BAe 146, is hijacked and deliberately crashed near Cayucos, California by a disgruntled airline employee. All 43 people on board, including the hijacker, are killed.

[edit] 1988

March 17 – Avianca Flight 410, a Boeing 727, crashes into terrain near Cúcuta, Colombia after takeoff due to pilot error. All 142 people on board die.
• **April 28** – *Aloha Airlines Flight 243*, a *Boeing 737*, suffers *explosive decompression* during flight but manages to land safely. Of 95 people on board, one *flight attendant* is blown out of the plane and killed, and several passengers are injured.

• **July 3** – *Iran Air Flight 655*, an *Airbus A300*, is shot down over Iranian waters by the missile cruiser *USS Vincennes* near *Dubai*. All 290 people on board are killed.

• **August 31** – *Delta Air Lines Flight 1141*, a *Boeing 727*, crashes on takeoff from *Dallas-Fort Worth International Airport* due to pilot error. Of 108 people on board, 10 passengers and two crew members are killed.

• **October 19** – *Indian Airlines Flight 113* hits an electric mast five miles (eight km) out on approach in poor visibility in *Ahmedabad, India*. All six crew members and 124 of 129 passengers were killed.

• **December 21** – *Pan Am Flight 103*, a *Boeing 747*, disintegrates in the air over *Lockerbie, Scotland* after a terrorist bomb explodes on board. All 259 people on board and 11 on the ground are killed. The incident became known as the *Lockerbie air disaster*.

[edit] 1989

• **January 8** – *British Midland Flight 92*, a *Boeing 737*, crashes near *Leicester* after one of its engines loses a fan blade and fails. Of the 118 passengers and 8 crew, 79 survive. The incident became known as the *Kegworth air disaster*.

• **February 8** – *Independent Air Flight 1851*, a *Boeing 707*, crashes into a hill on approach to *Santa Maria, the Azores*. All 144 people on board are killed.

• **February 24** – *United Airlines Flight 811*, a *Boeing 747*, suffers an *explosive decompression* shortly after takeoff from *Honolulu, Hawaii*, caused by a cargo door which burst open during flight. Of 355 people on board, nine passengers are sucked out of the plane, but the crew manage to land safely at Honolulu.
• **March 10** – Air Ontario **Flight 1363**, a Fokker F28, crashes immediately after takeoff from Dryden, Ontario due to ice on the wings, killing 24 of 69 people on board.

• **June 7** – Surinam Airways **Flight PY764**, a Douglas DC-8, crashes while attempting to land in heavy fog at Paramaribo, Suriname. The plane hits trees and flips upside down, killing 176 of 187 people on board.

• **July 19** – United Airlines **Flight 232**, a McDonnell Douglas DC-10, suffers a complete hydraulic system failure over Iowa after the tail-mounted engine disintegrates. The crew maintains partial control of the aircraft using differential throttle, bringing it to a crash landing on the runway of the Sioux City, Iowa airport. Of the 296 people on board, 111 die.

• **September 3** – Varig **Flight 254**, a Boeing 737, runs out of fuel due to incorrect navigation and crashes in the Brazilian jungle, killing 13 of the 54 people on board.

• **September 8** – Partnair **Flight 394**, a Convair 580, crashes into the North Sea after its tail section falls off in midair. All 55 people on board perish.

• **September 19** – UTA **Flight 772**, a McDonnell Douglas DC-10, explodes in mid-air over the Sahara desert when a bomb hidden in its forward cargo hold detonates. All 170 people on board are killed. Responsibility for the bombing is later traced back to Abdullah Sanussi, the brother-in-law of Libyan leader Muammar Gaddafi, whose government in 2003 agrees to pay compensation to the victims.

• **November 27** – Avianca **Flight 203**, a Boeing 727, explodes in mid-air over Colombia, killing all 107 people on board and three people on the ground. The Medellín Cartel claimed responsibility for the attack.

• **December 15** - KLM **Flight 867**, a Boeing 747 flying from Amsterdam to Anchorage, Alaska, flew through a cloud of volcanic debris, and subsequently all four engines shut down. The crew was able to restart the engines and land the plane safely.
January 25 – Avianca Flight 52, a Boeing 707, runs out of fuel and crashes while attempting to land at John F. Kennedy International Airport in New York. Of the 158 people on board, 85 survive.

February 14 – Indian Airlines Flight 605, an Airbus A320, crashes on its final approach to Bangalore airport. 92 out of 146 people on board are killed.

June 10 – British Airways Flight 5390, a BAC One-Eleven, suffers explosive decompression over Didcot, Oxfordshire, England when one of the front windscreen panes blows out. The captain is partially sucked out of the cockpit, but a flight attendant manages to keep his unconscious body from falling from the aircraft. The first officer lands the aircraft safely at Southampton Airport. All on board survive.

February 1 – USAir Flight 1493, a Boeing 737, strikes a Fairchild Metro commuter plane waiting to take off from the same runway on which the Boeing 737 was landing at Los Angeles International Airport. Of the 101 people on both aircraft, 34 people, including all 12 aboard the Metro and 22 of the Boeing 737 passengers, are killed.

March 3 – United Airlines Flight 585, a Boeing 737, crashes while attempting to land at Colorado Springs, Colorado, killing all 25 people on board. The cause of the crash is not identified until the investigation into the crash of USAir Flight 427 in 1994; both crashes are eventually attributed to defects in a valve associated with the rudder.

March 26 – Singapore Airlines Flight 117 is hijacked by Pakistani militants en route to Singapore, where, upon landing, it is stormed by Singapore Special Operations forces. All of the hijackers are killed in the operation, with no fatalities amongst the passengers and crew.

April 5 – Atlantic Southeast Airlines Flight 2311, an Embraer 120RT Brasilia, rolls sharply and crashes on final approach to Brunswick, Georgia,
killing all 23 people on board, including former Texas senator John Tower, his adult daughter, and astronaut Sonny Carter.

- **May 26** – Lauda Air **Flight 004**, a Boeing 767, disintegrates in mid-air over Uthai Thani Province, Thailand, killing all 223 people on board. A thrust reverser had accidentally deployed in flight, causing the disaster.

- **11 July** – Nigeria Airways **Flight 2120**, a Nationair DC-8-61 chartered by Nigeria Airways to transport Nigerian pilgrims to Mecca caught fire and crashed shortly after takeoff from Jeddah, Saudi Arabia, due to fire caused by tyre failure, killing all 261 on board, including 14 Canadian aircrew.

- **August 16** – Indian Airlines **Flight 257** hits high ground during descent about 30 km from the Imphal airport. All six crew members and 63 passengers were killed.

- **September 11** – Continental Express **Flight 2574** crashes on descent in Eagle Lake, Texas, killing all 14 people on board. Maintenance crews traded work shifts during repairs to the horizontal stabilizer, inadvertently leaving 47 bolts missing. Reformers pointed to this error and called for development of a "safety culture".

- **December 27** – Both engines of SAS **Flight 751**, an MD-81, fail shortly after takeoff from Stockholm, Sweden. The pilots successfully make an emergency landing in a nearby field, injuring 25 passengers but incurring not a single fatality.

[edit] 1992

- **March 22** – USAir **Flight 405**, a Fokker F-28, crashes on takeoff from New York due to ice buildup. Twenty-seven of the 51 people on board are killed. The then-president of Cleveland, Ohio's renowned Cleveland Clinic is among the survivors.

- **July 30** – TWA **Flight 843** aborts takeoff at John F. Kennedy International Airport. The Lockheed L-1011 turns off the runway onto grass in order to
avoid striking a concrete barrier. The plane is destroyed by fire shortly after all 292 passengers and crew evacuate with no loss of life.

- **July 31** – Thai Airways International **Flight 311** crashed on approach into Kathmandu, Nepal, killing all 12 crew and 99 passengers on board.
- **September 28** – Pakistan International Airlines **Flight 268**, an **Airbus A300**, crashes near Kathmandu, Nepal, killing all 12 crew and 155 passengers.
- **October 4** – El Al **Flight 1862**, a Boeing 747 freighter, crashes into high-rise apartment buildings in Amsterdam after two of its engines detach from the wing. Forty-three people, including the plane's crew of 3, are killed. The incident became known as the *Bijlmerramp* (Bijlmer disaster).
- **December 21** – Martinair **Flight 495** crashes in Faro, Portugal, killing 54 people and injuring 106.

**[edit] 1993**

- **April 26** – Indian Airlines **Flight 491**, a Boeing 737, strikes a large vehicle on a road just outside the Aurangabad airport and crashes subsequently, killing 55 of the 118 people onboard.
- **May 19** – SAM Colombia **SAM Colombia Flight 505**, a Boeing 727, The plane, on route from Panama City, Panama, to Medellin, hit Mt. Paramo de Frontino at 12,300 ft. while on approach to Maria Cordova Airport. Errors by the crew and the ATC. The aircraft descended into mountainous terrain before actually reaching the Abejorral NDB beacon. The VOR/DME had been sabotaged by terrorists and not in service. All 132 passengers (including a group of Panamanian dentists on their way to a convention) were killed.
- **July 26** – Asiana Airlines **Flight 733**, a Boeing 737, crashes into a mountain in Haenam, South Korea after failed landing attempts, killing 78 of the 110 people onboard.
- **September 14** – Lufthansa **Flight 2904**, an Airbus A320, crashes after overrunning the runway in Warsaw, Poland, killing 2 and injuring 68 of the 72 people on board.
- **September 21** – **Transair Georgian Airline Crash (21 September)**: A Tupolev Tu-134A is hit on approach to Sukhumi-Babusheri Airport by a *surface-to-air missile*; the plane crashes into the *Black Sea*, killing all five crew members and all 22 passengers.

- **September 22** – **Transair Georgian Airline Crash (22 September)**: Another plane, a Tupolev Tu-154A carrying refugees from a besieged city, Tbilisi, is shot down on takeoff from Sukhumi-Babusheri Airport; the plane crashes on the runway and catches fire, killing 106 of the 132 people on board.

- **September 23** – **Transair Georgian Airline Crash (22 September)**: A Tupolev Tu-134A is hit by mortar or artillery fire while passengers are boarding the plane; the plane catches fire, killing one person.

*edit* **1994**

- **March 23** – Aeroflot **Flight 593**, an Airbus A310, crashes into a wooded hillside in *Siberia*. All 75 passengers and crew are killed.

- **April 7** - FedEx **Flight 705**, a McDonnell Douglas DC-10, encounters an attempted hijacking by a FedEx employee. The three crew members are heavily injured, but manage to subdue the attacker and land the aircraft safely with no loss of life.

- **April 26** – China Airlines **Flight 140**, an Airbus A300, crashes while landing at Nagoya, Japan due to pilot error. 264 people of the 271 on board die.

- **July 2** – USAir **Flight 1016**, a DC-9, crashes while attempting to land at Charlotte, North Carolina during a thunderstorm. 37 of the 51 people on board are killed.

- **July 19** – Alas Chiricanas **Flight 00901**, an Embraer EMB-110, explodes in mid-air over Panama, killing all 21 people on board. Investigators conclude that a suicide bomber caused the plane to explode, although motives and affiliation of the bomber remain unclear.
- **September 8** – USAir **Flight 427**, a **Boeing 737**, crashes while attempting to land at **Pittsburgh, Pennsylvania**, killing all 133 people on board. Investigations showed that a fault in the Boeing 737 **rudder** was to blame for the crash.

- **October 31** – American Eagle **Flight 4184**, an **ATR 72** turboprop, crashes while waiting to land at **Chicago, Illinois**, due to ice buildup on its wings. All 68 people on board die.

- **December 11** – A bomb explodes on board **Philippine Airlines Flight 434**, a **Boeing 747**, killing one passenger, in a prelude to terrorist plot **Oplan Bojinka**. Despite subsequent difficulties in controlling the aircraft, the crew succeeds in making an emergency landing at **Naha, Okinawa**.

- **December 24** – Air France **Flight 8969**, an **Airbus A300**, is hijacked on the tarmac at **Algiers, Algeria** by the militant group **GIA**. After a two-day standoff, the plane is allowed to fly to **Marseille, France**, where it is stormed by **French commandos** who kill the hijackers.

**[edit] 1995**

- **March 31** – Tarom **Flight 371**, an **Airbus A310**, crashes near **Baloteşti, Romania** killing all 60 on board.

- **June 5** – Ansett New Zealand **Flight 703**, a **de Havilland DHC-8**, crashes during a landing approach near **Tararua Range, New Zealand** killing four of the 21 people on board.

- **August 21** – Atlantic Southeast Airlines **Flight 529**, an **Embraer EMB-120 Brasilia**, crashes in a field near **Carrollton, Georgia** in the **United States**, killing 10 of the 29 people on board.

- **December 18** – A **Trans Service Airlift Lockheed L-188 Electra crashes** after taking off from **Jamba, Angola**, due to overloading. Of the 144 people on board, 141 are killed.
December 13 - A Romavia Antonov AN-24 registered YR-AMR, crashes after taking off from Verona airport, due to overloading and ice accumulated on the wings, killing all 4 crew and all 45 passengers.

December 20 – American Airlines Flight 965, a Boeing 757, crashes into a mountain while approaching Santiago de Cali, Colombia; of the 164 people on board, only 4 people and a dog survive.

[edit] 1996

January 8 - An overloaded Air Africa Antonov An-32 aborts takeoff and overruns into a market in Kinshasa, Democratic Republic of the Congo, killing 297.

February 6 – Birgenair Flight 301, a Boeing 757 with 189 people on board, crashes into the ocean off Puerto Plata in the Dominican Republic shortly after taking off. All passengers and crew are killed.

February 29 – Compañía de Aviación Faucett Flight 251, a Boeing 737, crashes into a hill while attempting to land at Arequipa, Peru. All 123 people on board die.

May 11 – ValuJet Airlines Flight 592, a McDonnell Douglas DC-9, crashes in the Everglades near Miami, Florida, due to a fire in its cargo hold. All 110 people on board are killed.

July 17 – TWA Flight 800, a Boeing 747, explodes in mid-air above the ocean off East Moriches, New York, killing all 230 people on board.

August 19 - Spair Airlines Flight PAR-3601 crashed near Belgrade

August 29 – Vnukovo Airlines Flight 2801, a Tupolev Tu-154, crashes into a mountain on Spitsbergen, an island in the Norwegian archipelago of Svalbard, killing all 141 on board.

October 2 – Aeroperú Flight 603, a Boeing 757, crashes into the ocean off Pasamayo, Peru, due to a maintenance error. All 70 people on board are killed.
October 31 – TAM Linhas Aéreas Flight 402, a Fokker 100, crashes shortly after takeoff from Congonhas/São Paulo International Airport, Brazil, striking an apartment building and several houses. All 90 passengers and 6 crew members on board die. Three people are killed on the ground.

November 12 – Saudi Arabian Airlines Flight 763, a Boeing 747, collides in mid-air with Air Kazakhstan Flight 1907, an Ilyushin Il-76, near Charkhi Dadri, India. All 312 on board the Boeing 747 and all 37 on board the Ilyushin Il-76 die.

November 23 – Ethiopian Airlines Flight 961, a Boeing 767, is hijacked over Kenya. The aircraft runs out of fuel, and the pilot attempts to ditch the aircraft in the ocean off Moroni, Comoros. Of the 175 people on board, 123 are killed.

[edit] 1997

January 9 – Comair Flight 3272, an Embraer EMB-120 Brasilia, crashes near Ida, Michigan during a snowstorm. All 29 on board die.

May 8 – China Southern Airlines Flight 3456, a Boeing 737, makes a hard landing in Shenzhen, China during poor weather and crashes, killing 35 of the 74 people on board.

August 6 – Korean Air Flight 801, a Boeing 747, crashes while attempting to land in heavy rain in Hagåtña, Guam. Of the 254 people on board, 228 die.

September 26 – Garuda Indonesia Flight 152, an Airbus A300, crashes into a mountain near Buah Nabar, Indonesia killing all 234 on board.

December 16 – Air Canada Flight 646, a Canadair CRJ-100, crashes after a failed go-around attempt in Fredericton, New Brunswick. All passengers and crew survive.

December 19 – SilkAir Flight 185, a Boeing 737, crashes abruptly into the Musi River near Palembang, Indonesia, killing all 102 people on board.
1998

- **February 2** – Cebu Pacific Air **Flight 387**, a McDonnell-Douglas DC-9, crashes into a mountain near Pagalungan in the Philippines. The plane was flying an unfamiliar route not well documented in maps following an unscheduled stop in Leyte to drop off two mechanics. All 104 passengers and crew members are killed.

- **February 16** – China Airlines **Flight 676**, an Airbus A300, crashes into a residential area while attempting to land in Taipei, Taiwan. All 196 people on board are killed, in addition to six on the ground.

- **March 22** – Philippine Airlines **Flight 137**, an Airbus A320, overshoots the end of the runway while landing at Bacolod City in the Philippines, plowing through several houses. None of the passengers were harmed, but three people on the ground were killed and several more injured.

- **September 2** – Swissair **Flight 111**, a McDonnell Douglas MD-11, crashes into the sea near Halifax, Nova Scotia in Canada, due to an onboard fire. All 229 people on board perish.

- **December 11** – Thai Airways **Flight 261**, an Airbus A310, crashes during poor weather near Surat Thani, Thailand. Of the 146 people on board, 102 are killed.

1999

- **June 1** – American Airlines **Flight 1420**, a McDonnell Douglas MD-82, skids off the runway on landing at Little Rock, Arkansas during strong winds. Eleven of 145 on board die.

- **July 24** – All Nippon Airways **Flight 61**, a Boeing 747, is hijacked by a passenger, Yuji Nishizawa, wielding a knife. After fatally stabbing the captain, he is overpowered by the crew. The first officer lands the plane safely at Haneda, Japan.
• **August 22** – China Airlines **Flight 642**, a McDonnell Douglas MD-11, crashes on landing at Hong Kong International Airport during Tropical Storm Sam. Of the 315 people on board, three die.

• **August 31** – LAPA **Flight 3142**, a Boeing 737, overshoots the runway in Buenos Aires, Argentina and crashes into a golf course. Of the 103 people on board, 64 are killed as well as ten on the ground.

• **September 14** – Britannia Airways **Flight BY226A**, a Boeing 757, veers off the runway at Gerona, Spain while landing in a thunderstorm and comes to rest in a field, broken apart in two places; no fatalities.

• **September 23** – Qantas **Flight 1**, a Boeing 747, overshoots the runway upon landing in Bangkok, Thailand. None of the 410 people on board are seriously injured.

• **October 31** – EgyptAir **Flight 990**, a Boeing 767 on its way to Cairo, Egypt, crashes into the Atlantic Ocean off Nantucket, Massachusetts. All 217 passengers and crew members on board are killed.

• **November 9** – TAESA **Flight 725**, a McDonnell Douglas DC-9, crashes near Uruapan, Mexico killing all 18 on board.

• **December 24** – Indian Airlines **Flight 814**, an Airbus A300, is hijacked by Pakistani Terrorists en route to Delhi, India. Some local miscreants of Nepal were also involved in the planning of the hijacking. After stopovers in Amritsar, Lahore, and Dubai, it lands in Kandahar, Afghanistan, where after several days of negotiations, all the hostages are released in exchange for the release of three senior Islamic terrorists held by India. One Hostage Rupin Katyal was killed by the hijackers.

**[edit] 2000**

• **January 10** – Crossair **Flight 498**, a Saab 340, crashes two minutes after takeoff in Niederhasli, Switzerland, killing all ten people on-board.
January 30 – Kenya Airways **Flight 431**, an **Airbus A310**, carrying 169 passengers and 10 crew members, crashes into the **Atlantic Ocean** off **Côte d'Ivoire** after takeoff from **Abidjan**. Only ten people survive.

January 31 – Alaska Airlines **Flight 261**, an **MD-83**, crashes into the **Pacific Ocean** off **Point Mugu, California** after problems with its horizontal stabilizer. All 83 passengers and 5 crew members are killed.

March 5 – Southwest Airlines **Flight 1455**, a **Boeing 737**, overruns the runway in **Burbank, California**. Of the 142 people on board, 43 are injured, two seriously.

April 19 – Air Philippines **Flight 541**, a **Boeing 737-200**, crashes in a coconut grove on **Samal Island, Davao del Norte** while preparing to approach the **Davao International Airport**, killing all 131 people on board.

July 12 – Hapag-Lloyd Airlines **Flight 3378**, an **Airbus A310**, landed 500 meters short of the runway in **Vienna** after running out of fuel in flight. There were no serious injuries or fatalities.

July 17 – Alliance Air **Flight 7412**, a **Boeing 737**, crashes into government housing in **Patna, India** as it approaches the airport, killing 55 of the 58 on board and five people on the ground.

July 25 – Air France **Flight 4590**, an **Aerospatiale-BAC Concorde**, crashes during takeoff from **Paris, France** after its fuel tank catches fire. All 9 crew members and 100 passengers are killed as well as four people on the ground. This crash led to the Concorde's being grounded for two years, and, indirectly, to its eventual retirement.

August 23 – Gulf Air **Flight 072**, an **Airbus A320**, crashes into the **Persian Gulf** off **Manama, Bahrain** while attempting to land. All 143 passengers and eight crew members are killed.

October 31 – Singapore Airlines **Flight 006**, a **Boeing 747**, strikes construction equipment after using a closed runway for takeoff in **Taipei, Taiwan** and crashes, killing 83 out of 179 people on board.
2001

- **January 31** - Japan Airlines **Flight 907** and Japan Airlines **Flight 958** narrowly avoid colliding near Yaizu, Japan

- **August 24** – Air Transat **Flight 236** runs out of fuel over the Atlantic Ocean and makes an emergency landing in the Azores. Upon landing some of the tires blow out, causing a fire that is extinguished by emergency personnel on the ground. None of the 304 people on board the Airbus A330 are seriously injured.

![Image of fireball caused by American Airlines Flight 77 as it hits the Pentagon](image)

- **September 11** – **September 11, 2001 attacks**
  - **American Airlines Flight 11**, a Boeing 767 with 92 people on board, is hijacked after taking off from Boston, and is flown into the north tower of the World Trade Center in New York City. All on board are killed as well as many more on the ground and in the building.
  
  - **United Airlines Flight 175**, a Boeing 767 with 65 people on board, is hijacked after taking off from Boston and is flown into the south tower of the World Trade Center in New York City. All on board are killed as well as many more on the ground and in the building. The collapse of both towers brings the total death toll from the two crashes to at least 2,759 including the hijackers and 343 firefighters.
  
  - **American Airlines Flight 77**, a Boeing 757 with 64 people on board, is hijacked after taking off from Dulles International Airport and is flown...
into the Pentagon in Arlington County, Virginia. All on board are killed as well as 125 people in the building and on the ground.

- United Airlines Flight 93, a Boeing 757 with 44 people on board, is hijacked after taking off from Newark, New Jersey. After passengers struggle with the hijackers, the aircraft crashes in a field near Shanksville, Pennsylvania, killing all on board.

- October 4 – Siberia Airlines Flight 1812, a Tupolev Tu-154, is shot down by a Ukrainian missile over the Black Sea. All 66 passengers and 12 crew members are killed.

- October 8 – SAS Flight 686, a MD-87, crashes into a Cessna business jet on takeoff from Milan, Italy. The MD-87 then swerves into a baggage handling building and catches fire. All 110 people on board Flight 686 die as well as all four in the Cessna. Four people on the ground are also killed.

- November 12 – American Airlines Flight 587, an Airbus A300, crashes into a Queens neighborhood in New York City when the plane's vertical tail fin snaps just after takeoff. All 251 passengers and nine crew members on board are killed as well as five people on the ground.

- November 24 – Crossair Flight 3597, a BAe 146, crashes at Birchwil, Switzerland, while attempting to land in Zürich. Of the 28 passenger and five crew members on board, 21 passengers and three crew members die.

- December 22 – On board American Airlines Flight 63, a Boeing 767, a passenger, Richard Reid, attempts to detonate explosives hidden in his shoe, but fails and is subdued by passengers and crew. The plane lands safely in Boston.

[edit] 2002

- January 14 – Lion Air Flight JT-386, a Boeing 737, crashes while attempting to take off from Riau, Indonesia. All 103 on board survive.
April 15 – Air China Flight 129, a Boeing 767, crashes into a hill during a landing attempt at Busan, South Korea in misty conditions. Of the 155 passengers and 11 crew, 38 survive.

May 7 – China Northern Airlines Flight 6136, an MD-82, crashes near Dalian, China, after a passenger sets fire to the cabin with gasoline. All 103 passengers and 9 crew members are killed.

May 25 – China Airlines Flight 611, a Boeing 747, disintegrates above the Taiwan Strait, apparently due to metal fatigue. All 206 passengers and 19 crew members are killed.

July 1 – Bashkirian Airlines Flight 2937, a Tupolev Tu-154 with 57 passengers and 14 crew members on board, collides with a DHL Boeing 757 cargo plane with 2 pilots on board near Lake Constance, Germany. All people on both planes perish.

July 1 – America West Airlines Flight 556, an Airbus 319, is ordered back to the terminal at Miami, Florida after security screeners report that the pilots are intoxicated. The passengers are allowed to fly to Phoenix, Arizona on other airlines. The pilots are eventually given prison sentences.

November 6 – Luxair Flight 9642, a Fokker 50, crashes short of the runway while landing near Niederanven, Luxembourg in foggy conditions. Of the 19 passengers and three crew members on board, only two survive.

[edit] 2003

January 8 – Air Midwest Flight 5481, a Beechcraft 1900, crashes on takeoff from Charlotte North Carolina in the United States; all 19 passengers and 2 pilots are killed.

March 6 – Air Algerie Flight 6289, a Boeing 737, veers off the runway on takeoff in Tamanrasset, Algeria; 96 of the 97 passengers and all 6 crew members perish.
• **May 29** – A man attempts to hijack QantasLink Flight 1737 in Melbourne, Australia, intending to crash the plane in Tasmania. He is overpowered by the flight crew and passengers, but injures three people.

• **November 22** – A DHL Airbus A300 is struck by a missile near Baghdad, Iraq and loses hydraulic system function, but manages to land safely without any fatalities. This is the first safe landing of an airliner without control surfaces.

• **December 25** – Union des Transports Aériens de Guinée Flight 141, a Boeing 727, overshoots the runway upon landing at Cotonou, Benin and crashes onto the beach on the Bight of Benin, killing 151 of the 163 occupants.

> [edit] 2004

• **January 3** – Flash Airlines Flight 604, a Boeing 737, crashes into the Red Sea, killing all 135 passengers and 13 crew members.

• **May 9** – American Eagle Flight 5401 is damaged by high winds during landing in San Juan, Puerto Rico, injuring 13 people.

• **August 13** – Air Tahoma Flight 185, a Convair 580, crashes near Covington, Kentucky while descending to land, killing the first officer.

• **August 24** – **Russian aircraft bombings of August 2004**:
  - Siberia Airlines Flight 1047, a Tupolev Tu-154, explodes in mid-air while flying over Rostov Oblast, Russia killing all 38 passengers and 8 crew members on board.
  - Volga-AviaExpress Flight 1303, a Tupolev Tu-134, explodes in mid-air while flying over Tula Oblast, Russia killing all 34 passengers and 9 crew members on board.

• **October 19** – Corporate Airlines Flight 5966, a Handley Page Jetstream, crashes near Kirksville, Missouri in the United States; 13 of the 15 people on board die.
- **November 21** – China Eastern Airlines [Flight 5210](#) crashes near Baotou, China after takeoff due to snow and ice on the control surfaces. All 53 on board and two people on the ground are killed.

- **November 30** – Lion Air [Flight 538](#), a DC-9, crash-lands in Solo City, Indonesia, killing 25 of the 154 people on board.

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**[edit] 2005**

The burnt-out wreckage of Flight 358 at Toronto Pearson International Airport

- **February 3** – Kam Air [Flight 904](#), a Boeing 737, crashes in a snowstorm in Afghanistan. All 96 passengers and eight crew members die.

- **May 3** – Airwork [Flight 23](#), a [Fairchild Swearingen Metroliner](#) crashes in Taranaki, New Zealand killing both crew members.

- **June 9** – US Airways [Flight 1170](#) and Aer Lingus [Flight 132](#) almost collide on a runway at Logan International Airport in Boston, Massachusetts. None of the 381 people on either planes are harmed.

- **August 2** – Air France [Flight 358](#), an Airbus A340, skids off a runway in Toronto, Ontario, while landing and catches fire; all 309 on board escape without fatalities or serious injuries, but the aircraft is completely destroyed by the fire.

- **August 10** – A Copterline Sikorsky S-76 helicopter crashes off Tallinn, Estonia killing all 14 on board.

- **August 14** – Helios Airways [Flight 522](#), a Boeing 737, crashes near Kalamos, Greece with 115 passengers and 6 crew members on board; there are no survivors.
- **August 16** – West Caribbean Airways **Flight 708**, an MD-82, crashes in western *Venezuela*. All on board, 152 passengers and 8 crew members, die.
- **August 23** – TANS Peru **Flight 204**, a Boeing 737, crashes near *Pucallpa, Peru*. Forty of the 92 passengers on board, as well as four of the six crew members, perish.
- **September 5** – Mandala Airlines **Flight 091**, a Boeing 737, crashes in *Medan, Indonesia*, killing 103 of the 111 passengers and all 5 crew members on the plane and an additional 47 people on the ground.

JetBlue Airways Flight 292 upon landing in Los Angeles

- **September 21** – JetBlue Airways **Flight 292**, an Airbus A320, makes an emergency landing in *Los Angeles, California* in the *United States*. There are no injuries to the 139 passengers and six crew members.
- **October 22** – Bellview Airlines **Flight 210**, a Boeing 737, crashes in central *Nigeria*, killing all 117 people on board.
- **December 7** – A passenger disembarking American Airlines **Flight 924**, a Boeing 757, in *Miami, Florida* is shot and killed by an air marshal when the marshal believes that he hears the man say that he has a bomb.
- **December 8** – Southwest Airlines **Flight 1248**, a Boeing 737, slides off the runway during landing at *Chicago Midway International Airport* in *Chicago, Illinois* in heavy snow. None of the people on board are injured, but the plane hits two automobiles on the ground, killing a six-year-old boy.
- **December 10** – Sosoliso Airlines **Flight 1145**, a DC-9 with 110 people on board, crashes during landing in *Port Harcourt, Nigeria*. 107 people die.
- **December 19** – Chalk’s Ocean Airways **Flight 101**, a Grumman Mallard, crashes off the coast of *Miami Beach, Florida*, killing all 20 on board.
May 3 – Armavia Flight 967, an Airbus A320, crashes into the Black Sea near the Russian city of Sochi, killing all 113 on board.

July 9 – S7 Airlines Flight 778, an Airbus A310, crashes into a concrete barricade and catches fire on landing in Irkutsk, Russia. Of the 203 people on board, 128 are killed.

July 10 – Pakistan International Airlines Flight 688, a Fokker F27, crashes into a wheat field near Multan, Pakistan ten minutes after taking off, killing all 41 passengers and 4 crew members on board.

August 22 – Pulkovo Airlines Flight 612, a Tupolev Tu-154, crashes near Donetsk, Ukraine, killing all 170 people on board.

August 27 – Comair Flight 5191, a CRJ-100, crashes during takeoff near Lexington, Kentucky, killing 49 of the 50 people on board.

September 1 – An Iran Air Tours Tu-154 carrying 148 people crashes while attempting to land in Mashad, Iran killing 28 people.

September 29 – Gol Transportes Aéreos Flight 1907, a Boeing 737, collides with an Embraer Legacy business jet and crashes in Mato Grosso, Brazil. The Embraer Legacy, with seven on board, lands safely with no reported injuries. All 154 people on board the Boeing 737 perish.

October 3 – Turkish Airlines Flight 1476, a Boeing 737, is hijacked over Greece. The plane lands in Brindisi, Italy. None of the 113 people on board are hurt.

October 10 – Atlantic Airways Flight 670, a BAe 146, slides off the runway at Stord, Norway, killing four of the 16 people on board.

October 29 – ADC Airlines Flight 53, a Boeing 737, crashes near Abuja, Nigeria, killing 97 of the 104 people on board.
January 1 – Adam Air Flight 574, a Boeing 737 with 102 people on board, crashes into the ocean off the island of Sulawesi in Indonesia, killing all on board.

January 9 – An AerianTur-M Antonov An-26 crashes near Balad, Iraq, killing 34 of the 35 people on board. The official cause of the crash is poor weather conditions, but other sources claim that the plane was shot down by a missile.

January 24 – Air West Flight 612, a Boeing 737 with 103 people on board, is hijacked over Sudan shortly after taking off from Khartoum, but lands safely in N'Djamena, Chad.

February 15 – An Air Mauritanie Boeing 737 is hijacked after taking off from Nouakchott, Mauritania, but lands safely in Las Palmas, Spain without any serious injuries among the 79 people on board.

February 21 – Adam Air Flight 172, a Boeing 737, suffers structural damage while landing near Surabaya, Indonesia. None of the 149 people on board were seriously injured.

March 7 – Garuda Indonesia Flight 200, a Boeing 737, overshoots the runway and crashes while landing at Yogyakarta, Indonesia, killing 22 of the 140 people on board.

March 17 – UTair Flight 471, a Tupolev Tu-134, suffers severe structural damage while landing in Samara, Russia, killing six of the 63 people on board.

March 23 – A TransAVIAexport Airlines Ilyushin Il-76 crashes in Mogadishu, Somalia killing all 11 on board; the plane, which crashes during the Battle of Mogadishu, is thought to have been shot down.

March 30 – A Sudan Airways flight with 284 people on board is hijacked but lands safely in Khartoum, Sudan.

May 5 – Kenya Airways Flight 507, a Boeing 737 with 114 people on board, crashes near Douala, Cameroon killing everyone on board.
- **June 3** – A Paramount Airlines Mil Mi-8 helicopter crashes in Lungi, Sierra Leone killing all 22 people on board.

- **June 21** – A Free Airlines Let-410UVP crashes shortly after takeoff from Kamina Town, Democratic Republic of Congo due to severe overloading, killing 1 and injuring 4 of the 21 people onboard.

- **June 25** – PMTair Flight 241, an Antonov An-24, crashes in southwestern Cambodia killing all 22 on board.

- **June 28** – A TAAG Angola Airlines Boeing 737, D2-TBP, with 78 people on board, loses control while landing and crashes in M'banza-Kongo, Angola, killing at least six people on board and injuring an unknown number of others.

The wreckage of TAM Linhas Aéreas Flight 3054

- **July 17** – TAM Linhas Aéreas Flight 3054, an Airbus A320, in São Paulo, Brazil killing all 187 people on board and 12 on the ground.

- **July 27** – Two news helicopters, both Eurocopter Ecureuils, one from KNXV-TV and one KTVK collide in Phoenix, Arizona in the United States, while covering a car chase. All on both helicopters, two from each, were killed.

- **August 9** – An Air Moorea de Havilland Canada DHC-6 Twin Otter crashes on the island of Moorea in French Polynesia killing all 20 on board.

- **August 20** – China Airlines Flight 120, a Boeing 737, bursts into flames after landing at Naha, Japan. None of the 165 passengers were seriously injured.

- **Scandinavian Airlines** 2007 Dash 8 landing gear incidents:
• **September 9** – Scandinavian Airlines Flight 1209, a de Havilland Canada Dash 8, experiences a landing gear failure in Aalborg, Denmark. None of the 73 people on board were seriously injured, but three days later, after a similar incident, the airline grounds the type. A similar incident on October 27 causes the airline to remove all its Dash 8s from service.

• **September 12** – Scandinavian Airlines Flight 2748, a de Havilland Canada Dash 8, experiences a landing gear failure in Vilnius, Lithuania. None of the 52 people on board were injured, but due to a similar incident three days prior, all their Dash 8s are grounded.

• **October 27** – Scandinavian Airlines Flight 2867, a de Havilland Canada Dash 8, experiences a landing gear failure in Copenhagen, Denmark. None of the 44 people on board were injured, but due to similar incidents in September, airline permanently removes all its Dash 8s from service.

• **September 16** – One-Two-GO Airlines Flight 269, a McDonnell Douglas MD-82 carrying 130 people, crashes and bursts into flames after attempting to land in Phuket, Thailand during poor weather conditions killing 89 people.

• **October 4** – An Africa One Antonov An-26 crashes into a residential area Kinshasa, Democratic Republic of the Congo, shortly after taking off. At least 50 people are killed, most of whom were on the ground.

• **November 30** – Atlasjet Flight 4203, a McDonnell Douglas MD-83, crashes into a mountain near Isparta, Turkey killing all 57 on board.

**[edit] 2008**

• **January 4** – A scheduled domestic Transaven flight of undetermined number from Simón Bolívar International Airport to Los Roques Airport with 14 or 18 people on board reportedly suffers dual engine failure 64 miles offshore at 3000 feet and heading 024 away from the point of departure, and is lost shortly thereafter with no trace found.
January 10 – **Air Canada Flight 190** enroute from *Victoria* to *Toronto* experiences severe *turbulence* over the *Rocky Mountains*, injuring ten passengers (six seriously), and is forced to divert and make an emergency landing in *Calgary*. The cause is under investigation.

January 17 – **British Airways Flight 38** a *Boeing 777* from *Beijing* to *London* lands short of the runway at *Heathrow Airport*. The plane is badly damaged in this incident but there are no fatalities. Thirteen people are treated for minor injuries.

- **Nigeria has six geopolitical zones the are**
- **Habitat of the giant panda is located in China**

Earth's atmosphere

"Air" redirects here. For other uses, see *Air* (disambiguation).

<table>
<thead>
<tr>
<th>Nitrogen</th>
<th>78.0842%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>20.9463%</td>
</tr>
<tr>
<td>Argon</td>
<td>0.93422%</td>
</tr>
</tbody>
</table>
Layers of the atmosphere (not to scale)

**Earth's atmosphere** is a layer of gases surrounding the planet Earth and retained by the Earth's gravity. It contains roughly (by molar content/volume) 78% nitrogen, 20.95% oxygen, 0.93% argon, 0.038% carbon dioxide, trace amounts of other gases, and a variable amount (average around 1%) of water vapor. This mixture of gases is commonly known as air. The atmosphere protects life on Earth by absorbing ultraviolet solar radiation and reducing temperature extremes between day and night.

There is no definite boundary between the atmosphere and outer space. It slowly becomes thinner and fades into space. Three quarters of the atmosphere's mass is within 11 km of the planetary surface. In the United States, people who travel above an altitude of 80.5 km (50 statute miles) are designated astronauts. An altitude of 120 km (~75 miles or 400,000 ft) marks the boundary where atmospheric effects become noticeable during re-entry. The Kármán line, at 100 km (62 miles or 328,000 ft), is also frequently regarded as the boundary between atmosphere and outer space.
Temperature and layers

The temperature of the Earth's atmosphere varies with altitude; the mathematical relationship between temperature and altitude varies among six different atmospheric layers (ordered highest to lowest):

- **Exosphere**: from 500 – 1000 km (300 – 600 mi) up to 10,000 km (6,000 mi), free-moving particles that may migrate into and out of the magnetosphere or the solar wind.

  - *exobase* boundary

- **Ionosphere**: is the part of the atmosphere that is ionized by solar radiation. It plays an important part in atmospheric electricity and forms the inner edge of the magnetosphere. It has practical importance because, among other functions, it influences radio propagation to distant places on the Earth. It is located in the thermosphere and is responsible for auroras.
thermopause boundary

- **Thermosphere**: from 80 – 85 km (265,000 – 285,000 ft) to 640+ km (400+ mi), temperature increasing with height.

mesopause boundary

- **Mesosphere**: From the Greek word "μέσος" meaning middle. The mesosphere extends from about 50 km (160,000 ft) to the range of 80 to 85 km (265,000 – 285,000 ft), temperature decreasing with height. This is also where most meteors burn up when entering the atmosphere.

stratopause boundary

- **Stratosphere**: From the Latin word "stratus" meaning a spreading out. The stratosphere extends from the troposphere's 7 to 17 km (23,000 – 60,000 ft) range to about 50 km (160,000 ft). Temperature increases with height. The stratosphere contains the ozone layer, the part of the Earth's atmosphere which contains relatively high concentrations of ozone. "Relatively high" means a few parts per million—much higher than the concentrations in the lower atmosphere but still small compared to the main components of the atmosphere. It is mainly located in the lower portion of the stratosphere from approximately 15 to 35 km (50,000 – 115,000 ft) above Earth's surface, though the thickness varies seasonally and geographically.

tropopause boundary

- **Troposphere**: From the Greek word "τρέπω" meaning to turn or change. The troposphere is the lowest layer of the atmosphere; it begins at the surface and extends to between 7 km (23,000 ft) at the poles and 17 km (60,000 ft) at the equator, with some variation due to weather factors. The troposphere has a great deal of vertical mixing due to solar heating at the surface. This heating warms air masses, which makes them less dense so they rise. When an air mass rises the pressure upon it decreases so it
expands, doing work against the opposing pressure of the surrounding air. To do work is to expend energy, so the temperature of the air mass decreases. As the temperature decreases, water vapor in the air mass may condense or solidify, releasing latent heat that further uplifts the air mass. This process determines the maximum rate of decline of temperature with height, called the adiabatic lapse rate. It contains roughly 80% of the total mass of the atmosphere. 50% of the total mass of the atmosphere is located in the lower 5km of the troposphere.

The average temperature of the atmosphere at the surface of Earth is 15 °C (59 °F).[1]

[edit] Pressure and thickness

Main article: Atmospheric pressure

Barometric Formula: (used for airplane flight) barometric formula

One mathematical model: NRLMSISE-00

The average atmospheric pressure, at sea level, is about 101.3 kilopascals (about 14.7 psi); total atmospheric mass is 5.1361×10^{18} kg [1].

Atmospheric pressure is a direct result of the total weight of the air above the point at which the pressure is measured. This means that air pressure varies with location and time, because the amount (and weight) of air above the earth varies with location and time.

Atmospheric pressure decreases with height, dropping by 50% at an altitude of about 5.6 km (18,000 ft). Equivalently, about 50% of the total atmospheric mass is within the lowest 5.6 km. This pressure drop is approximately exponential, so that pressure decreases by approximately half every 5.6 km. However, because of changes in temperature throughout the atmospheric column, as well as the fact that the force of gravity begins to decrease at great altitudes, a single equation does not model atmospheric pressure through all altitudes (it is modeled in 7 exponentially decreasing layers, in the equations given above).
Even in the exosphere, the atmosphere is still present (as can be seen for example by the effects of atmospheric drag on satellites).

The equations of pressure by altitude in the above references can be used directly to estimate atmospheric thickness. However, the following published data are given for reference:- [2]

- 50% of the atmosphere by mass is below an altitude of 5.6 km.
- 90% of the atmosphere by mass is below an altitude of 16 km. The common altitude of commercial airliners is about 10 km.
- 99.99997% of the atmosphere by mass is below 100 km. The highest X-15 plane flight in 1963 reached an altitude of 354,300 ft or 108 km.

Therefore, most of the atmosphere (99.9997%) is below 100 km, although in the rarefied region above this there are auroras and other atmospheric effects.

[edit] Composition

Composition of Earth's atmosphere as at 1987-Dec. The lower pie represents the least common gases that compose 0.038% of the atmosphere. Values normalized for illustration.

Mean atmospheric water vapor

Composition of dry atmosphere, by volume[3]
**ppmv**: parts per million by volume

<table>
<thead>
<tr>
<th>Gas</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nitrogen</strong> (N$_2$)</td>
<td>780,840 ppmv (78.084%)</td>
</tr>
<tr>
<td><strong>Oxygen</strong> (O$_2$)</td>
<td>209,460 ppmv (20.946%)</td>
</tr>
<tr>
<td><strong>Argon</strong> (Ar)</td>
<td>9,340 ppmv (0.9340%)</td>
</tr>
<tr>
<td><strong>Carbon dioxide</strong> (CO$_2$)</td>
<td>383 ppmv (0.0383%)</td>
</tr>
<tr>
<td><strong>Neon</strong> (Ne)</td>
<td>18.18 ppmv (0.001818%)</td>
</tr>
<tr>
<td><strong>Helium</strong> (He)</td>
<td>5.24 ppmv (0.000524%)</td>
</tr>
<tr>
<td><strong>Methane</strong> (CH$_4$)</td>
<td>1.745 ppmv (0.0001745%)</td>
</tr>
<tr>
<td><strong>Krypton</strong></td>
<td>1.14 ppmv (0.000114%)</td>
</tr>
<tr>
<td>(Kr)</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td><strong>Hydrogen</strong> (H₂)</td>
<td>0.55 ppmv (0.000055%)</td>
</tr>
</tbody>
</table>

**Not included in above dry atmosphere:**

| **Water vapor** (H₂O) | ~0.25% over full atmosphere, typically 1% to 4% near surface |

**Minor components of air not listed above include:** [citation needed]

<table>
<thead>
<tr>
<th>Gas</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>nitrous oxide</td>
<td>0.3 ppmv (0.00005%)</td>
</tr>
<tr>
<td>xenon</td>
<td>0.09 ppmv (9x10⁻⁶%)</td>
</tr>
<tr>
<td>ozone</td>
<td>0.0 to 0.07 ppmv (0%-7x10⁻⁶%)</td>
</tr>
<tr>
<td>nitrogen dioxide</td>
<td>0.02 ppmv (2x10⁻⁶%)</td>
</tr>
<tr>
<td>Substance</td>
<td>Concentration</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------</td>
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| iodine          | 0.01 ppmv (1x10^{-6}%)
| carbon monoxide | trace         |
| ammonia         | trace         |

The mean molar mass of air is 28.97 g/mol. Note that the composition figures above are by volume-fraction (V%), which for **ideal gases** is equal to mole-fraction (that is, fraction of total molecules). By contrast, **mass-fraction** abundances of gases, particularly for gases with significantly different molecular (molar) mass from that of air will differ from those by volume. For example, in air, helium is 5.2 ppm by **volume-fraction** and **mole-fraction**, but only about \((4/29) \times 5.2 \text{ ppm} = 0.72\text{ ppm}\) by **mass-fraction**.

### Heterosphere

Below the **turbopause** at an altitude of about 100 km (not far from the mesopause), the Earth's atmosphere has a more-or-less uniform composition (apart from water vapor) as described above; this constitutes the **homosphere**. However, above about 100 km, the Earth's atmosphere begins to have a composition which varies with altitude. This is essentially because, in the absence of mixing, the density of a gas falls off exponentially with increasing altitude, but at a rate which depends on the **molar mass**. Thus higher mass constituents, such as oxygen and nitrogen, fall off more quickly than lighter constituents such as **helium**, molecular **hydrogen**, and atomic hydrogen. Thus there is a layer, called the **heterosphere**, in which the earth's atmosphere has varying composition. As the altitude increases, the atmosphere is dominated successively by helium, molecular hydrogen, and atomic hydrogen. The precise altitude of the heterosphere and the layers it contains varies significantly with temperature. After loss of the hydrogen,
helium and other hydrogen-containing gases from early Earth due to the Sun's radiation, primitive Earth was devoid of an atmosphere. The first atmosphere was formed by outgassing of gases trapped in the interior of the early Earth, which still goes on today in volcanoes. [5]

**Density and mass**

*Main article: Density of air*

Earth's atmosphere from space

The density of air at sea level is about 1.2 kg/m³ (1.2 g/L). Natural variations of the barometric pressure occur at any one altitude as a consequence of weather. This variation is relatively small for inhabited altitudes but much more pronounced in the outer atmosphere and space due to variable solar radiation.

Temperature and mass density against altitude from the NRLMSISE-00 standard atmosphere model

The atmospheric density decreases as the altitude increases. This variation can be approximately modeled using the barometric formula. More sophisticated models are used by meteorologists and space agencies to predict weather and orbital decay of satellites.

The average mass of the atmosphere is about 5,000 trillion metric tons or 1/1,200,000 the mass of Earth. According to the National Center for Atmospheric
Research, "The total mean mass of the atmosphere is $5.1480 \times 10^{18}$ kg with an annual range due to water vapor of $1.2$ or $1.5 \times 10^{15}$ kg depending on whether surface pressure or water vapor data are used; somewhat smaller than the previous estimate. The mean mass of water vapor is estimated as $1.27 \times 10^{16}$ kg and the dry air mass as $5.1352 \pm 0.0003 \times 10^{18}$ kg."

[edit] Evolution on Earth

See also: History of Earth

Atmospheric gases scatter blue light more than other wavelengths, giving the Earth a blue halo when seen from space.

The history of the Earth's atmosphere prior to one billion years ago is poorly understood and an active area of scientific research. The following discussion presents a plausible scenario.

The modern atmosphere is sometimes referred to as Earth's "third atmosphere", in order to distinguish the current chemical composition from two notably different previous compositions. The original atmosphere was primarily helium and hydrogen. Heat from the still-molten crust, and the sun, plus a probably enhanced solar wind, dissipated this atmosphere.

About 4.4 billion years ago, the surface had cooled enough to form a crust, still heavily populated with volcanoes which released steam, carbon dioxide, and ammonia. This led to the early "second atmosphere", which was primarily carbon dioxide and water vapor, with some nitrogen but virtually no oxygen. This second atmosphere had approximately 100 times as much gas as the current atmosphere, but as it cooled much of the carbon dioxide was dissolved in the seas and
precipitated out as carbonates. The later "second atmosphere" contained largely nitrogen and carbon dioxide. However, simulations run at the University of Waterloo and University of Colorado in 2005 suggest that it may have had up to 40% hydrogen. It is generally believed that the greenhouse effect, caused by high levels of carbon dioxide and methane, kept the Earth from freezing.

One of the earliest types of bacteria was the cyanobacteria. Fossil evidence indicates that bacteria shaped like these existed approximately 3.3 billion years ago and were the first oxygen-producing evolving phototropic organisms. They were responsible for the initial conversion of the earth's atmosphere from an anoxic state to an oxic state (that is, from a state without oxygen to a state with oxygen) during the period 2.7 to 2.2 billion years ago. Being the first to carry out oxygenic photosynthesis, they were able to produce oxygen while sequestering carbon dioxide in organic molecules, playing a major role in oxygenating the atmosphere.

Photosynthesising plants would later evolve and continue releasing oxygen and sequestering carbon dioxide. Over time, excess carbon became locked in fossil fuels, sedimentary rocks (notably limestone), and animal shells. As oxygen was released, it reacted with ammonia to release nitrogen; in addition, bacteria would also convert ammonia into nitrogen. But most of the nitrogen currently present in the atmosphere results from sunlight-powered photolysis of ammonia released steadily over the aeons from volcanoes.

As more plants appeared, the levels of oxygen increased significantly, while carbon dioxide levels dropped. At first the oxygen combined with various elements (such as iron), but eventually oxygen accumulated in the atmosphere, resulting in mass extinctions and further evolution. With the appearance of an ozone layer (ozone is an allotrope of oxygen) lifeforms were better protected from ultraviolet radiation. This oxygen-nitrogen atmosphere is the "third atmosphere". 200 – 250 million years ago, up to 35 percent of the atmosphere was oxygen (bubbles of ancient atmosphere were found in an amber).
This modern atmosphere has a composition which is enforced by oceanic blue-green algae as well as geological processes. \( \text{O}_2 \) does not remain naturally free in an atmosphere, but tends to be consumed (by inorganic chemical reactions, as well as by animals, bacteria, and even land plants at night), while \( \text{CO}_2 \) tends to be produced by respiration and decomposition and oxidation of organic matter. Oxygen would vanish within a few million years due to chemical reactions and \( \text{CO}_2 \) dissolves easily in water and would be gone in millennia if not replaced. Both are maintained by biological productivity and geological forces seemingly working hand-in-hand to maintain reasonably steady levels over millions of years (see Gaia theory).

[edit] Air pollution

Before desulfurization filters were installed, the emissions from this power plant in New Mexico contained excessive amounts of sulfur dioxide.

Main article: Air pollution

Air pollution is a chemical, physical (e.g. particulate matter) or biological agent that modifies the natural characteristics of the atmosphere in an unwanted way. Stratospheric ozone depletion due to air pollution (chiefly from chlorofluorocarbons) has long been recognized as a threat to human health as well as to the earth's ecosystems.

Worldwide air pollution is responsible for large numbers of deaths and cases of respiratory disease. Enforced air quality standards, like the Clean Air Act in the United States, have reduced the presence of some pollutants. While major stationary sources are often identified with air pollution, the greatest source of emissions is actually mobile sources, principally the automobile. Gases such as

[Image] Air pollution

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[Image] Air pollution
carbon dioxide, methane, and fluorocarbons contribute to global warming, and these gases, or excess amounts of some emitted from fossil fuel burning, have recently been identified by the United States and many other countries (see Kyoto accord), as pollutants.

[edit] References

1. ^ Earth's Radiation Balance and Oceanic Heat Fluxes.
3. ^ Source for figures: Carbon dioxide, NASA Earth Fact Sheet, (updated 2007.01). Methane, IPCC TAR table 6.1, (updated to 1998). The NASA total was 17 ppmv over 100%, and CO₂ was increased here by 15 ppmv. To normalize, N₂ should be reduced by about 25 ppmv and O₂ by about 7 ppmv.
4. ^ homosphere—AMS Glossary
5. ^ Vercheval, J. The thermosphere: a part of the heterosphere. (offline, see Internet Archive copy)
6. ^ "Early Earth atmosphere favorable to

-Ozone layer

The ozone layer exists in the stratospheric layer of the earth’s atmosphere where ozone concentrations are nearly one thousand times higher than in the troposphere.

Ozone is produced by lightning and solar irradiation of oxygen molecules.

Ozone is formed by reactions that start with the splitting of O₂ to form two atomic oxygen (O) atoms. Atomic oxygen (O) will react with another O₂ molecule to form ozone (O₃).
Ozone can be destroyed by catalytic reactions involving chlorine, bromine, etc.

Chlorine has been directly implicated in the formation of the Antarctic ozone hole.

**Ozone protects life on earth by absorbing most incoming solar ultraviolet radiation**

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**Oil refinery**

An **oil refinery** is an industrial **process** plant where **crude oil** is processed and refined into more useful **petroleum products**, such as **gasoline**, **diesel fuel**, **asphalt base**, **heating oil**, **kerosine**, and **liquefied petroleum gas**.[1][2] Oil refineries are typically large sprawling **industrial** complexes with extensive **piping** running throughout, carrying streams of **fluids** between large **chemical processing** units.
Operation

Crude oil is separated into fractions by fractional distillation. The fractions at the top of the fractionating column have lower boiling points than the fractions at the bottom. The heavy bottom fractions are often cracked into lighter, more useful products. All of the fractions are processed further in other refining units.

Raw oil or unprocessed ("crude") oil is not useful in the form it comes in out of the ground. Although "light, sweet" (low viscosity, low sulfur) oil has been used directly as a burner fuel for steam vessel propulsion, the lighter elements form explosive vapors in the fuel tanks and so it is quite dangerous, especially so in warships. For this and many other uses, the oil needs to be separated into parts and refined before use in fuels and lubricants, and before some of the byproducts
could be used in petrochemical processes to form materials such as plastics, detergents, solvents, elastomers, and fibers such as nylon and polyesters. Petroleum fossil fuels are used in ship, automobile and aircraft engines. These different hydrocarbons have different boiling points, which means they can be separated by distillation. Since the lighter liquid elements are in great demand for use in internal combustion engines, a modern refinery will convert heavy hydrocarbons and lighter gaseous elements into these higher value products using complex and energy intensive processes.

Shell Oil Refinery, Martinez, California

Oil can be used in so many various ways because it contains hydrocarbons of varying molecular masses, forms and lengths such as paraffins, aromatics,
Hydrocarbons are molecules of varying length and complexity made of only hydrogen and carbon atoms. Their various structures give them their differing properties and thereby uses. The trick in the oil refinement process is separating and purifying these.

Once separated and purified of any contaminants and impurities, the fuel or lubricant can be sold without any further processing. Smaller molecules such as isobutane and propylene or butylenes can be recombined to meet specific octane requirements of fuels by processes such as alkylation or less commonly, dimerization. Octane grade of gasoline can also be improved by catalytic reforming, which strips hydrogen out of hydrocarbons to produce aromatics, which have much higher octane ratings. Intermediate products such as gasoils can even be reprocessed to break a heavy, long-chained oil into a lighter short-chained one, by various forms of cracking such as Fluid Catalytic Cracking, Thermal Cracking, and Hydrocracking. The final step in gasoline production is the blending of fuels with different octane ratings, vapor pressures, and other properties to meet product specifications.

Oil refineries are large scale plants, processing from about a hundred thousand to several hundred thousand barrels of crude oil per day. Because of the high capacity, many of the units are operated continuously (as opposed to processing in batches) at steady state or approximately steady state for long periods of time (months to years). This high capacity also makes process optimization and advanced process control very desirable.

**[edit] Major products of oil refineries**

Most products of oil processing are usually grouped into three categories: light distillates (LPG, gasoline, naptha), middle distillates (kerosene, diesel), heavy distillates and residuum (fuel oil, lubricating oils, wax, tar). This classification is based on the way crude oil is distilled and separated into fractions (called distillates and residuum) as can be seen in the above drawing.\[^{[2]}\]
- **Liquid petroleum gas** (LPG)
- **Gasoline** (also known as petrol)
- **Naphtha**
- **Kerosene** and related **jet aircraft fuels**
- **Diesel fuel**
- **Fuel oils**
- **Lubricating oils**
- **Paraffin wax**
- **Asphalt** and **Tar**
- **Petroleum coke**

**Common process units found in a refinery**

- **Desalter** unit washes out salt from the crude oil before it enters the atmospheric distillation unit.
- Atmospheric Distillation unit distills crude oil into fractions. See Continuous distillation.
- **Vacuum Distillation** unit further distills residual bottoms after atmospheric distillation.
- Naphtha **Hydrotreater** unit uses **hydrogen** to desulfurize naphtha from atmospheric distillation. Must hydrotreat the naphtha before sending to a Catalytic Reformer unit.
- **Catalytic Reformer** unit is used to convert the naphtha-boiling range molecules into higher octane **reformate** (reformer product). The reformate has higher content of aromatics, olefins, and cyclic hydrocarbons. An important byproduct of a reformer is hydrogen released during the catalyst reaction. The hydrogen is used either in the hydrotreaters or the hydrocracker.
- Distillate Hydrotreater unit desulfurizes distillates (such as diesel) after atmospheric distillation.
- **Fluid Catalytic Cracking** (FCC) unit upgrades heavier fractions into lighter, more valuable products.
- **Hydrocracker** unit uses hydrogen to upgrade heavier fractions into lighter, more valuable products.
- **Visbreaking** unit upgrades heavy residual oils by thermally cracking them into lighter, more valuable reduced viscosity products.
- **Merox** unit treats LPG, kerosene or jet fuel by oxidizing mercaptans to organic disulfides.
- **Coking units** (either delayed or fluid coking) process very heavy residual oils into gasoline and diesel fuel, leaving petroleum coke as a residual product.
- **Alkylation** unit produces high-octane component for gasoline blending.
- **Dimerization** unit converts olefins into higher-octane gasoline blending components. For example, butenes can be dimerized into isooctene which may subsequently be hydrogenated to form isooctane. There are also other uses for dimerization.
- **Isomerization** unit converts linear molecules to higher-octane branched molecules for blending into gasoline or feed to alkylation units.
- **Steam reforming** unit produces hydrogen for the hydrotreaters or hydrocracker.
- Liquified gas storage units for propane and similar gaseous fuels at pressure sufficient to maintain in liquid form. These are usually spherical vessels or bullets (horizontal vessels with rounded ends).
- Storage tanks for crude oil and finished products, usually cylindrical, with some sort of vapor emission control and surrounded by an earthen berm to contain spills.
- **Amine gas treater**, **Claus unit**, and tail gas treatment for converting hydrogen sulfide from hydridesulfurization into elemental sulfur.
- Utility units such as **cooling towers** for circulating cooling water, **boiler plants** for steam generation, instrument air systems for pneumatically operated **control valves** and an **electrical substation**.
Wastewater collection and treating systems consisting of API separators, dissolved air flotation (DAF) units and some type of further treatment (such as an activated sludge biotreater) to make such water suitable for reuse or for disposal.[3]

Solvent refining units use solvent such as cresol or furfural to remove unwanted, mainly asphaltenic materials from lubricating oil stock (or diesel stock).

Solvent dewaxing units remove the heavy waxy constituents petrolatum from vacuum distillation products.

[edit] Flow diagram of typical refinery

The image below is a schematic flow diagram of a typical oil refinery that depicts the various unit processes and the flow of intermediate product streams that occurs between the inlet crude oil feedstock and the final end products. The diagram depicts only one of the literally hundreds of different oil refinery configurations. The diagram also does not include any of the usual refinery facilities providing utilities such as steam, cooling water, and electric power as well as storage tanks for crude oil feedstock and for intermediate products and end products.[1][4][5][6]
Schematic flow diagram of a typical oil refinery

**Vacuum distillation**

In an alternative processing scheme, the vacuum distillation unit may separate the atmospheric residue to produce also the unrefined fractions for the following products: spindle oil (used in the textile industry), light machinery oil, motor oil, and steam cylinder oil.
Specialty end products

These will blend various feedstocks, mix appropriate additives, provide short term storage, and prepare for bulk loading to trucks, barges, product ships, and railcars.

- Gaseous fuels such as propane, stored and shipped in liquid form under pressure in specialized railcars to distributors.
- Liquid fuels blending (producing automotive and aviation grades of gasoline, kerosene, various aviation turbine fuels, and diesel fuels, adding dyes, detergents, antiknock additives, oxygenates, and anti-fungal compounds as required). Shipped by barge, rail, and tanker ship. May be shipped regionally in dedicated pipelines to point consumers, particularly aviation jet fuel to major airports, or piped to distributors in multi-product pipelines using product separators called pipeline inspection gauges ("pigs").
- Lubricants (produces light machine oils, motor oils, and greases, adding viscosity stabilizers as required), usually shipped in bulk to an offsite packaging plant.
- Wax (paraffin), used in the packaging of frozen foods, among others. May be shipped in bulk to a site to prepare as packaged blocks.
- Sulfur (or sulfuric acid), byproducts of sulfur removal from petroleum which may have up to a couple percent sulfur as organic sulfur-containing compounds. Sulfur and sulfuric acid are useful industrial materials. Sulfuric acid is usually prepared and shipped as the acid precursor oleum.
- Bulk tar shipping for offsite unit packaging for use in tar-and-gravel roofing.
- Asphalt unit. Prepares bulk asphalt for shipment.
- Petroleum coke, used in specialty carbon products or as solid fuel.
- Petrochemicals or petrochemical feedstocks, which are often sent to petrochemical plants for further processing in a variety of ways. The petrochemicals may be olefins or their precursors, or various types of aromatic petrochemicals.
Siting/locating of petroleum refineries

The principles of finding a construction site for refineries are similar to those for other chemical plants:

- The site has to be reasonably far from residential areas.
- Facilities for raw materials access and products delivery to markets should be easily available.
- Processing energy requirements should be easily available.
- Waste product disposal should not cause difficulties.

For refineries which use large amounts of process steam and cooling water, an abundant source of water is important. Because of this, oil refineries are often located (associated to a port) near navigable rivers or even better on a sea shore. Either are of dual purpose, making also available cheap transport by river or by sea. Although the advantages of crude oil transport by pipeline are evident, and the method is also often used by oil companies to deliver large output products such as fuels to their bulk distribution terminals, pipeline delivery is not practical for small output products. For these, rail cars, road tankers or barges may be used.

It is useful to site refineries in areas where there is abundant space to be used by the same company or others, for the construction of petrochemical plants, solvent manufacturing (fine fractionating) plants and/or similar plants to allow these easy access to large output refinery products for further processing, or plants that produce chemical additives that the refinery may need to blend into a product at source rather than at blending terminals.
Safety and environmental concerns

MiRO refinery at Karlsruhe

The refining process releases numerous different chemicals into the atmosphere; consequently, there are substantial air pollution emissions and a notable odor normally accompanies the presence of a refinery. Aside from air pollution impacts there are also wastewater concerns, risks of industrial accidents such as fire and explosion, and noise health effects due to industrial noise.

The public has demanded that many governments place restrictions on contaminants that refineries release, and most refineries have installed the equipment needed to comply with the requirements of the pertinent environmental protection regulatory agencies. In the United States, there is strong pressure to prevent the development of new refineries, and no major refinery has been built in the country since Marathon's Garyville, Louisiana facility in 1976. However, many existing refineries have been expanded during that time. Environmental restrictions and pressure to prevent construction of new refineries may have also contributed to rising fuel prices in the United States. Additionally, many refineries (over 100 since the 1980s) have closed due to obsolescence and/or merger activity within the industry itself. This activity has been reported to Congress and in specialized studies not widely publicised.

Environmental and safety concerns mean that oil refineries are sometimes located some distance away from major urban areas. Nevertheless, there are many
instances where refinery operations are close to populated areas and pose health risks such as in the Campo de Gibraltar, a Spanish state owned refinery near the towns of Gibraltar, Algeciras, La Linea, San Roque and Los Barrios with a combined population of over 300,000 residents within a 5 mile radius and the CEPSA refinery in Santa Cruz on the island of Tenerife, Spain[9] which is sited in a densely-populated city center and next to the only two major evacuation routes in and out of the city. In California's Contra Costa County and Solano County, a shoreline necklace of refineries and associated chemical plants are adjacent to urban areas in Richmond, Martinez, Pacheco, Concord, Pittsburg, Vallejo and Benicia, with occasional accidental events that require "shelter in place" orders to the adjacent populations.

[edit] History

The world's first oil refineries were set up by Ignacy Łukasiewicz near Jaslo, Austrian Empire (now in Poland) in the years 1854-56[10][11] but they were initially small as there was no real demand for refined fuel. As Łukasiewicz's kerosene lamp gained popularity the refining industry grew in the area.

The first large oil refinery opened at Ploiești, Romania in 1856.[12] Several other refineries were built at that location with investment from United States companies before being taken over by Nazi Germany during World War II. Most of these refineries were heavily bombarded by US Army Air Forces in Operation Tidal Wave, August 1, 1943. Since then they have been rebuilt, and currently pose somewhat of an environmental concern.

Another early example is Oljeön, now preserved as a museum at the UNESCO world heritage site Engelsberg. It started operation in 1875 and is part of the Ecomuseum Bergslagen.

At one time, the world's largest oil refinery was claimed to be Ras Tanura, Saudi Arabia, owned by Saudi Aramco. For most of the 20th century, the largest refinery of the world was the Abadan refinery in Iran. This refinery suffered extensive
damage during the war Iran-Iraq war. The world’s largest refinery complex is the "Centro de Refinación de Paraguaná" (CRP) operated by PDVSA in Venezuela with a production capacity of 956,000 barrels per day (Amuay 635,000 bpd, Cardón 305,000 bpd and Bajo Grande 16,000 bpd). SK Corporation’s Ulsan refinery in South Korea with a capacity of 840,000 bpd and Reliance Petroleum's refinery in Jamnagar, India with 660,000 bpd are the second and third largest, respectively.

Early US refineries processed crude oil to recover the kerosene. Other products (like gasoline) were considered wastes and were often dumped directly into the nearest river. The invention of the automobile shifted the demand to gasoline and diesel, which remain the primary refined products today. Refineries pre-dating the EPA were very toxic to the environment. Strict legislation has mandated that refineries meet modern air and water cleanliness standards. In fact, obtaining a permit to build even a modern refinery with minimal impact on the environment (other than CO₂ emissions) is so difficult and costly that no new refineries have been built (though many have been expanded) in the United States since 1976. As a result, some believe that this may be the reason that the US is becoming more and more dependent on the imports of finished gasoline, as opposed to incremental crude oil. On the other hand, studies have revealed that accelerating merger activity in the refining and production sector has reduced capacity further, resulting in tighter markets in the United States in particular.

[edit] See also

Storage tanks and towers at Shell Puget Sound Refinery (Shell Oil Company), Anacortes, Washington
Air pollution
AP 42 Compilation of Air Pollutant Emission Factors
API oil-water separator
Industrial wastewater treatment
Cooling tower
Ethanol fuel
Gas flare
List of oil refineries
Refinery
Acid gas
Sour gas

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4. ^Guide to Refining from Chevron Oil’s website

5. ^Refinery flowchart from Universal Oil Products’ website

6. ^An example flowchart of fractions from crude oil at a refinery

7. ^AP 42, Compilation of Air Pollutant Emission Factors

8. ^Behind high gas prices: The refinery crunch

9. ^Smoke, oil spills and now radiation - whatever next?


11. ^Warsaw University timeline

12. ^WORLD EVENTS: 1844-1856 www.pbs.org
Continuous distillation(CRUCAL OIL DISTILATION)

Continuous distillation, a form of distillation, is an ongoing separation in which a mixture is continuously (without interruption) fed into the process and separated fractions are removed continuously as output streams as time passes during the operation. A distillation is the separation or partial separation of a liquid feed mixture into components or fractions by selective boiling (or evaporation) and condensation. A distillation produces at least two output fractions. These fractions include at least one volatile distillate fraction, which has boiled and been separately captured as a vapor condensed to a liquid, and practically always a bottoms (or residuum) fraction, which is the least volatile residue that has not been separately captured as a condensed vapor.

An alternative to continuous distillation is batch distillation, where the mixture is added to the unit at the start of the distillation, distillate fractions are taken out sequentially in time (one after another) during the distillation, and the remaining bottoms fraction is removed at the end. Because each of the distillate fractions are taken out at different times, only one distillate exit point (location) is needed for a batch distillation and the distillate can just be switched to a different receiver, a fraction-collecting container. Batch distillation is often used when smaller quantities are distilled. In a continuous distillation, each of the fraction streams is taken simultaneously throughout operation; therefore, a separate exit point is needed for each fraction. In practice when there are multiple distillate fractions, each of the distillate exit points are located at different heights on a fractionating column. The bottoms fraction can be taken from the bottom of the distillation column or unit, but is often taken from a reboiler connected to the bottom of the column.

Each fraction may contain one or more components (types of chemical compounds). When distilling crude oil or a similar feedstock, each fraction
contains many components of similar volatility and other properties. Although it is possible to run a small-scale or laboratory continuous distillation, most often continuous distillation is used in a large-scale industrial process.

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    - 3.2.1 Reflux
    - 3.2.2 Plates or trays
    - 3.2.3 Packing
  - 3.3 Overhead system arrangements
- 4 Examples
  - 4.1 Continuous distillation of crude oil
- 5 See also
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Industrial application

Distillation is one of the unit operations of chemical engineering.[1][2] Continuous distillation is used widely in the chemical process industries where large quantities of liquids have to be distilled.[3][4][5] Such industries are the natural gas processing, petrochemical production, coal tar processing, brewing, liquified air separation, hydrocarbon solvents production and similar industries, but it finds its widest application in petroleum refineries. In such refineries, the crude oil feedstock is a very complex multicomponent mixture that must be separated and
yields of pure chemical compounds are not expected, only groups of compounds within a relatively small range of boiling points, which are called fractions. That is the origin of the name fractional distillation or fractionation. It is often not worthwhile separating the components in these fractions any further based on product requirements and economics.

Industrial distillation is typically performed in large, vertical cylindrical columns (as shown in images 1 and 2) known as "distillation towers" or "distillation columns" with diameters ranging from about 65 centimeters to 11 meters and heights ranging from about 6 meters to 60 meters or more.

[edit] Principle

Main article: Distillation

Image 3: Chemical engineering schematic of Continuous Binary Fractional Distillation tower. A binary distillation separates a feed mixture stream into two fractions: one distillate and one bottoms fraction.

The principle for continuous distillation is the same as for normal distillation: when a liquid mixture is heated so that it boils, the composition of the vapor above the liquid differs from the liquid composition. If this vapor is then separated and condensed into a liquid, it becomes richer in the lower boiling component(s) of the original mixture.

This is what happens in a continuous distillation column. A mixture is heated up, and routed into the distillation column. On entering the column, the feed starts flowing down but part of it, richer in lower boiling component(s), vaporizes and rises. However, as it rises, it cools and while part of it continues up as vapor, some of it (enriched in the less volatile component) begins to descend again.

Image 3 depicts a simple continuous fractional distillation tower for separating a feed stream into two fractions, an overhead distillate product and a bottoms
product. The "lightest" products (those with the lowest boiling point or highest volatility) exit from the top of the columns and the "heaviest" products (the bottoms, those with the highest boiling point) exit from the bottom of the column. The overhead stream may be cooled and condensed using a water-cooled or air-cooled condenser. The bottoms reboiler may be a steam-heated or hot oil-heated heat exchanger, or even a gas or oil-fired furnace.

In a continuous distillation, the system is kept in a steady state or approximate steady state. Steady state means that quantities related to the process do not change as time passes during operation. Such constant quantities include feed input rate, output stream rates, heating and cooling rates, reflux ratio, and temperatures, pressures, and compositions at every point (location). Unless the process is disturbed due to changes in feed, heating, ambient temperature, or condensing, steady state is normally maintained. This is also the main attraction of continuous distillation, apart from the minimum amount of (easily instrumentable) surveillance; if the feed rate and feed composition are kept constant, product rate and quality are also constant. Even when a variation in conditions occurs, modern process control methods are commonly able to gradually return the continuous process to another steady state again.

Since a continuous distillation unit is fed constantly with a feed mixture and not filled all at once like a batch distillation, a continuous distillation unit does not need a sizable distillation pot, vessel, or reservoir for a batch fill. Instead, the mixture can be fed directly into the column, where the actual separation occurs. The height of the feed point along the column can vary on the situation and is designed so as to provide optimal results. See McCabe-Thiele method.
A binary distillation separates a feed mixture stream into two fractions: one distillate and one bottoms fraction.

A continuous distillation is often a fractional distillation and can be a vacuum distillation or a steam distillation.

**Design and operation**

Design and operation of a distillation column depends on the feed and desired products. Given a simple, binary component feed, analytical methods such as the McCabe-Thiele method or the Fenske equation can be used to assist in the design. For a multi-component feed, computerized simulation models are used both for design and subsequently in operation of the column as well. Modeling is also used to optimize already erected columns for the distillation of mixtures other than those the distillation equipment was originally designed for.

When a continuous distillation column is in operation, it has to be closely monitored for changes in feed composition, operating temperature and product composition. Much of these tasks are performed these days using advanced computer control equipment.
Column feed

The column can be fed in different ways. If the feed is from a source at a pressure higher than the distillation column pressure, it is simply piped into the column. Otherwise, the feed is pumped or compressed into the column. The feed may be a superheated vapor, a saturated vapor, a partially vaporized liquid-vapor mixture, a saturated liquid (i.e., liquid at its boiling point at the column's pressure), or a sub-cooled liquid. If the feed is a liquid at a much higher pressure than the column pressure and flows through a pressure let-down valve just ahead of the column, it will immediately expand and undergo a partial flash vaporization resulting in a liquid-vapor mixture as it enters the distillation column.

Improving separation

Image 4: Simplified chemical engineering schematic of Continuous Fractional Distillation tower separating one feed mixture stream into four distillate and one bottoms fractions

Although small size units, mostly made of glass, can be used in laboratories, industrial units are large, vertical, steel vessels (see images 1 and 2) known as "distillation towers" or "distillation columns". To improve the separation, the tower is normally provided inside with horizontal plates or trays as shown in image 5, or the column is packed with a packing material. To provide the heat required for the vaporization involved in distillation and also to compensate for heat loss, heat is most often added to the bottom of the column by a reboiler, and the purity of the top product can be improved by recycling some of the externally condensed top product liquid as reflux. Depending on their purpose, distillation columns may have liquid outlets at intervals up the length of the column as shown in image 4.

Reflux
Large-scale industrial fractionation towers use reflux to achieve more efficient separation of products.[3][5] Reflux refers to the portion of the condensed overhead liquid product from a distillation tower that is returned to the upper part of the tower as shown in images 3 and 4. Inside the tower, the downflowing reflux liquid provides cooling and partial condensation of the upflowing vapors, thereby increasing the efficacy of the distillation tower. The more reflux that is provided, the better is the tower's separation of the lower boiling from the higher boiling components of the feed. A balance of heating with a reboiler at the bottom of a column and cooling by condensed reflux at the top of the column maintains a temperature gradient (or gradual temperature difference) along the height of the column to provide good conditions for fractionating the feed mixture.

Changing the reflux (in combination with changes in feed and product withdrawal) can also be used to improve the separation properties of a continuous distillation column while in operation (in contrast to adding plates or trays, or changing the packing, which would, at a minimum, require quite significant downtime).

[edit] Plates or trays
Distillation towers (such as in images 3 and 4) use various vapor and liquid contacting methods to provide the required number of equilibrium stages. Such devices are commonly known as "plates" or "trays". Each of these plates or trays is at a different temperature and pressure. The stage at the tower bottom has the highest pressure and temperature. Progressing upwards in the tower, the pressure and temperature decreases for each succeeding stage. The vapor-liquid equilibrium for each feed component in the tower reacts in its unique way to the different pressure and temperature conditions at each of the stages. That means that each component establishes a different concentration in the vapor and liquid phases at each of the stages, and this results in the separation of the components.
Some example trays are depicted in image 5. A more detailed, expanded image of two trays can be seen in the theoretical plate article. The reboiler often acts as an additional equilibrium stage.

If each physical tray or plate were 100% efficient, than the number of physical trays needed for a given separation would equal the number of equilibrium stages or theoretical plates. However, that is very seldom the case. Hence, a distillation column needs more plates than the required number of theoretical vapor-liquid equilibrium stages.

Fractionation Research, Inc. (commonly known as FRI) has performed research on all types of trays measuring their capacity, pressure drop and efficiency in hydrocarbon systems from full vacuum to 500 psia.\[9\]

[edit] Packing

Another way of improving the separation in a distillation column is to use a packing material instead of trays. These offer the advantage of a lower pressure drop across the column (when compared to plates or trays), beneficial when operating under vacuum. If a distillation tower uses packing instead of trays, the number of necessary theoretical equilibrium stages is first determined and then the packing height equivalent to a theoretical equilibrium stage, known as the height equivalent to a theoretical plate (HETP), is also determined. The total packing height required is the number theoretical stages multiplied by the HETP.

This packing material can either be random dumped packing such as Raschig rings or structured sheet metal. Liquids tend to wet the surface of the packing and the vapors pass across this wetted surface, where mass transfer takes place. Unlike conventional tray distillation in which every tray represents a separate point of vapor-liquid equilibrium, the vapor-liquid equilibrium curve in a packed column is continuous. However, when modeling packed columns it is useful to compute a number of theoretical plates to denote the separation efficiency of the packed column with respect to more traditional trays. Differently shaped packings have
different surface areas and void space between packings. Both of these factors affect packing performance.

Another factor in addition to the packing shape and surface area that affects the performance of random or structured packing is liquid and vapor distribution entering the packed bed. The number of theoretical stages required to make a given separation is calculated using a specific vapor to liquid ratio. If the liquid and vapor are not evenly distributed across the superficial tower area as it enters the packed bed, the liquid to vapor ratio will not be correct in the packed bed and the required separation will not be achieved. The packing will appear to not be working properly. The height equivalent to a theoretical plate (HETP) will be greater than expected. The problem is not the packing itself but the mal-distribution of the fluids entering the packed bed. Liquid mal-distribution is more frequently the problem than vapor. The design of the liquid distributors used to introduce the feed and reflux to a packed bed is critical to making the packing perform at maximum efficiency. Methods of evaluating the effectiveness of a liquid distributor can be found in references.\[10\][11. Considerable work as been done on this topic by Fractionation Research, Inc.[12]
[edit] Overhead system arrangements

Images 4 and 5 assume an overhead stream that is totally condensed into a liquid product using water or air-cooling. However, in many cases, the tower overhead is not easily condensed totally and the reflux drum must include a vent gas outlet stream. In yet other cases, the overhead stream may also contain water vapor because either the feed stream contains some water or some steam is injected into the distillation tower (which is the case in the crude oil distillation towers in oil refineries). In those cases, if the distillate product is insoluble in water, the reflux drum may contain a condensed liquid distillate phase, a condensed water phase and a non-condensible gas phase, which makes it necessary that the reflux drum also have a water outlet stream.

[edit] Examples

[edit] Continuous distillation of crude oil
Petroleum crude oils contain hundreds or more different hydrocarbon compounds: paraffins, naphthenes and aromatics as well as organic sulfur compounds, organic nitrogen compounds and some oxygen containing hydrocarbons such as phenols. Although crude oils generally do not contain olefins, they are formed in many of the processes used in a petroleum refinery.\[13\]

The crude oil fractionator does not produce products having a single boiling point, rather, it produces fractions having boiling ranges.\[13\][14] For example, the crude oil fractionator produces an overhead fraction called "naphtha" which will become a gasoline component after it is further processed through a catalytic hydodesulfurizer to remove sulfur and a catalytic reformer to reform its hydrocarbon molecules into more complex molecules with a higher octane rating value.

The naphtha "cut", as that fraction is called, has very many different hydrocarbon compounds. Therefore it has an "initial" boiling point of about 35°C and a "final" boiling point of about 200°C ... that is what is meant by the "boiling range" of each "cut" produced in the fractionating columns. At some distance below the overhead, the next "cut" is withdrawn from the side of the column and it is usually the jet fuel cut also known as a kerosene cut. It also contains very many different hydrocarbons and the boiling range of that cut is from an initial boiling point of about 150°C to a final boiling point of about 270°C. The next cut further down the tower is the diesel oil cut with a boiling range from about 180°F to about 315°C. Note the overlap of boiling range between any cut and the next cut because the distillation separations are not perfectly sharp.

After these come the heavy fuel oil cuts and finally the bottoms product, with very wide boiling ranges. All these cuts are processed further in subsequent refining processes.

[edit] See also

- Azeotropic distillation
How much proven crude oil reserves exist in the world?  
Frequently asked questions about crude oil
Frequently asked questions about the petroleum industry

World proven crude oil reserves are estimated at slightly more than 1.2 trillion barrels, of which OPEC Member Countries hold approximately 78 per cent.

OPEC's Members in 2007 produced around 32.1 million barrels per day of crude oil, or 44.9 per cent of the world total output, which stood at about 71.5 million barrels per day.

At the rate of production in 2007, OPEC crude oil reserves are sufficient to last more than 80 years.

Frequently asked questions

How does OPEC oil production affect oil prices?  
Frequently asked questions about crude oil
Frequently asked questions about OPEC
Frequently asked questions about the petroleum industry

The Oil and Energy Ministers of the OPEC Member Countries meet at least twice a year to co-ordinate their oil production policies in light of the market fundamentals, i.e., the likely future balance between supply and demand.

The Member Countries, represented by their respective Heads of Delegation, may or may not alter production levels during the Meetings of the OPEC Conference.

Given that OPEC Countries produce about 45 per cent of the world's crude oil and about 54 per cent of the oil traded internationally, any decisions to increase or reduce production may lower or raise the price of crude oil.

The impact of OPEC output decisions on crude oil prices should be considered separately from the issue of changes in the final prices of oil products, such as gasoline or heating oil. There are many factors that influence the prices paid by end consumers for oil products. In some
the final gasoline price paid by consumers, so even a major change in the price of crude oil might have only a minor impact on consumer prices.

Nigeria LNG Limited is jointly owned by Nigerian National Petroleum Corporation (49%), Shell (25.6%), Total LNG Nigeria Ltd (15%) and Eni (10.4%). It was incorporated as a limited liability company on May 17, 1989, to harness Nigeria's vast natural gas resources and produce Liquefied Natural Gas (LNG) and Natural Gas Liquids (NGLs) for export.

The company has a wholly-owned subsidiary, Bonny Gas Transport (BGT) Limited, which provides shipping services for NLNG.

Bonny Gas Transport was set up in 1989, following the incorporation of Nigeria LNG Limited, to take care of the shipping arm of the project. The company was set up in Bermuda...
with an ordinary equity holding from Nigeria LNG Limited and preferential equity holding from the sponsors, NLNG's shareholders.

Our Vision
…a global LNG company helping to build a better Nigeria.

Nigeria LNG will be a global LNG company renowned for its operational excellence, cost leadership, high HSE standards and for honesty and integrity. We will help to build a better Nigeria by utilising the country's gas resources and helping to put out the flares, thus diversifying the economy and cleaning up the environment.

We will set the standards in community relations, actively promote the development of Nigerian businesses and provide to our shareholders a good return on their investment.

We will provide for our staff an exciting and fulfilling place to work and the opportunity to develop their potential. We will execute and operate our business with an international outlook and mindset.