

The Bell Hueys

By diligent product development, Bell Helicopter has turned a small utility machine of the mid-1950s into a host of offspring, some carrying a payload almost double the laden weight of their ancestor. As a result the numbers built exceed those of any aircraft since 1945 except for the Antonov An-2.

No single name, number or designation really covers this family, except for the colloquial 'Huey', which is sufficiently loose to fit the lot. Yet can it really link a 700-hp (522-kW) six-seater with a 3,250-hp (2425-kW) 20-seater, and take in the fighter-like Cobra family on the way? Almost the only thing they have in common is that their distinctive rotor slap can be heard rumbling and thumping for several minutes before the machine finally comes into view, and even here there is an exception, the new Model 412 with its smaller and quieter four-blade main rotor.

This remarkable family, which looks set to notch up 15,000 sales, began with the issue of a document describing Support System 443L in early 1955. Experience in the Korean War had underscored the value of the helicopter in a land battle, not so much as a carrier of weapons but as a versatile utility transport system that can bring food and ammunition to a front-line outpost and take out the casualties. As millions know from the *M.A.S.H.* TV serial, Bell Helicopter was in on the ground floor with this work with its Model 47; but this had little more than 200 hp (149 kW) and was very limited in what it could carry. The US Army specification of 1955 looked to about three times this power, but in a neater and more modern machine than the Sikorsky S-55.

Not surprisingly, Bell won the US Army competition and in June 1955 was awarded a contract for three prototypes designated XH-40. Bell's designation was Model 204, and the design team under Bartram Kelley was pleased with its clean and efficient offering. So too was the engine supplier, Avco Lycoming, which had sought German engineers in order to underpin its new move into the field of turbine power. The T53, a free-turbine shaft engine of some 700 hp (522 kW), was the first US design by a team headed by Dr Anselm Franz, who during the war had masterminded the Jumo 004 programme which produced engines for the Messerschmitt Me 262, Arado Ar 234 and many other aircraft. The T53 was a conservative engine which promised to mature rapidly, whilst offering the basic turbine advantages of much better ratio of power to weight and bulk, greatly improved reliability, reduced fire risk, the ability to run on a wide range of fuels, and the elimination of complicated and power-absorbing cooling systems.

This beautiful picture shows both types of Huey in current front-line use by the US Marine Corps. The utility transport Iroquois is no. 151271, a UH-1E serving with the HMS-24 (Headquarter and Maintenance Sqn), based at Kaneohe Bay, Hawaii. In the rear is an AH-1J SeaCobra of the same unit, with tail code EW.



The World's Greatest Aircraft

Typical of the first Huey variant to be built in large numbers, this HU-1B (after 1962 redesignated UH-1B) was no. 64-13912, one of 1,014 of this model procured by the US Army. It is shown serving with the 1st Aviation Battalion, 1st Infantry Division (whose badge appears on the fin), with bulldog badge in 1967.



One of the early customers of the Italian Agusta company for licensed Bell Huey helicopters was the ÖL (Austrian air force) which used this AB 205 in the 3rd Helo Wing (Fliegerregiment) at Linz in the late 1960s. Subsequently both Fliegerregiments 1 and 3 re-equipped with the licensed twin-engined AB 212.

A particular advantage of the light and compact turboshaft engine was that it could be installed right next to the gearbox under the main rotor, where it was readily accessible yet did not encroach on the accommodation in the cabin. Compared with the S-55 the XH-40 had roughly the same cabin volume, but the cabin was wider and more efficient, the pilot and five passengers being all on the same low floor level, with side doors at a convenient height. For minimum weight the fuselage had a tadpole configuration, the large cabin section being joined to a slim boom carrying the fin and tail rotor. The main rotor was rather like a scaled-up and modernized Model 47 rotor, with two blades made wholly of light alloy, with an extruded spar, and with the company's patented stabilizer bar set at 90° to the blades. Engineering test pilot Floyd Carlson made the first flights at Fort Worth on 20 and 22 October 1956, and no severe problems were encountered.

By this time Bell was busy with a service-test batch of six YH-40s. These had the pre-production T53-L-1A engine of 700 hp (522 kW), a cabin 12 in (305 mm) longer to accommodate four stretchers (litters) and a wider crew door, as well as greater ground clearance and modified flight controls. Nine pre-production machines then followed, and it was their revised designation of HU-1A that gave rise to the universal name 'Huey', used far more often than the US Army official name of Iroquois. First delivery took place on 30 June 1959. The engine was by this time cleared to give 860 shp (642 kW), but it was flat-rated at 770 shp (574 kW) in all early Iroquois to give

constant output in hot and high conditions. Many early HU-1As were armed with various mixes of guns and rockets, while 14 were dual trainers with provision for real and simulated instrument instruction.

In 1959 work began on the YHU-1B, with the 960-shp (716-kW) T53-5 or 1,100-shp (821-kW) T53-11. This jump in power made possible a major increase in gross weight, from 5,800 lb (2631 kg) to 8,500 lb (3856 kg), and to transmit it the main-rotor blades were redesigned with increased chord and a honeycomb filling aft of the spar. The cabin was again enlarged to seat the pilot and eight passengers in three rows, or a crew of two and seven armed troops, or three stretchers, two sitting casualties and a medic, or a cargo load of 3,000 lb (1361 kg). This was roughly double the load lifted by the XH-40. The HU-1B first flew in 1960, and many of the production models had various armament schemes including two 30-mm cannon, two packs each of 24 rockets, quadruple 7.62-mm (0.3-in) machine-guns or a 40-mm grenade-launcher.

Increased accommodation

In 1962 the tri-service designation system changed the HU-1 into the UH-1, but without making the slightest dent in usage of the popular name. By this time Bell was well advanced in flight trials with the YUH-1D, which capitalized on the power of the L-11 engine to drive a 48-ft (14.63-m) rotor and lift an altogether bigger fuselage



No information is available on the owner of this early Bell 204, though it was photographed in the Fort Worth area. This original production model, based on the US Army H-40 of the 1950s, had a maximum laden weight much less than the useful payload of today's Model 214ST. Early Model 204s were six-seaters.



During the war in South-East Asia most US Army Hueys were painted plain khaki-brown, without insignia, but the South Vietnam air force Hueys were painted grey and did carry red/yellow/blue national markings. This UH-1H, pictured on a combat mission in August 1971, was one of hundreds left after the US withdraw.

Navy BuAer no. 158284 is one of a batch of 204 UH-1N-BF helicopters purchased by the US Navy (some on behalf of the Marine Corps). A standard 14-seat multi-role transport, this example has rescue gear and serves at Naval Air Station Agana, on Guam. The UH-1N is the standard Navy local base rescue helicopter.



This UH-1N Iroquois, Navy BuAer no. 158277, was bought as a standard machine and transferred to the Marine Corps, where it was converted into a VH-1N for VIP staff transportation. No. 158278 was similarly converted, and six Hueys were built as VH-1Ns. They have luxurious accommodation and extra communications.



able to accommodate the pilot and 12 troops, or six stretchers and a medic, or 4,000 lb (1814 kg) of freight. This was the first of the stretched Model 205 family, of which 6,000 were built in the first 10 years. Bell also continued to build more and more variants of the original Model 204 series, as noted in the variants list, but by the early 1970s these had almost completely given way to the more capable Model 205 family.

From 1961 Agusta SpA in Italy had been busy producing the AB.204 licensed version for many civil and military customers, including models with the Rolls-Royce Gnome (licensed T58) or the parent T58 engine. Deliveries to the Italian and Spanish navies included the AB.204AS with Ekco radar, autostabilization and autohover systems and many search and attack devices, as well as two Mk 44 torpedoes for anti-submarine operations. In Japan Fuji built large numbers for many customers using Kawasaki-built T53 engines. In 1970 Fuji began testing a high-speed winged development, the XMH. This was one of many attempts to overcome the first-generation Huey's only real drawback, its inability to fly faster than about 127 mph (204 km/h).

Bell concentrated instead on sheer capability in utility roles, and with the commercial Model 205A, basically a UH-1D but with the 1,400-shp (1044-kW) T53-13 and first flown in 1963, the slung payload went up to 5,000 lb (2268 kg), as an alternative to a pilot and 14 passengers! By the mid-1960s the T53-13 was the usual engine and it resulted in a designation of UH-1H for the US military models.

Agusta produced AB.205s in various forms, and 118 UH-1Hs were assembled, and increasingly constructed, in Taiwan.

In August 1962 Bell flew the Model 533, a YUH-1B grossly modified under US Army contract as a high-speed research vehicle. Fitted with a swept wing and two small jets it reached 254 mph (409 km/h) and pulled tight turns at over 200 mph (322 km/h). In 1969, refitted with two 3,300-lb (1497-kg) thrust J60 (JT12A) jets, it set a helicopter speed record at a remarkable 316 mph (509 km/h). This taught Bell a great deal, much of which was put to use in the mid-1960s when it was obvious that a specially designed helicopter gunship was needed in Vietnam. Bell had previously flown a gunship Model 47, the Sioux Scout of 1963, but the Huey was the preferred basis for a production machine. The result was the first AH-1G HueyCobra, in which the popular name was accepted as part of the official one.

Basically a UH-1C, which in 1965 introduced a new rotor, the AH-1G had a totally new fuselage only 36 in (914 mm) wide, with stepped tandem cockpits for a gunner/observer in the nose and the pilot behind and above, both under a fighter-like canopy. The rotor was the Model 540 type, with new wide blades of 27-in (686-mm) chord, with a 'door hinge' root, generating much more lift than before and, by flying at reduced angles, freeing the machine from previous speed restrictions. The first AH-1G flew on 7 September 1965, as the first of a new family, the Model 209. Problems were surprisingly few, and by March 1966 the AH-1G was in full pro-



The biggest single export order gained by any type of helicopter was for 202 Bell AH-1J Cobras, with TOW capability, for what in 1974 (when deliveries began) was the Kingdom of Iran. All had been delivered at the time of the revolution and they have since been heavily engaged in the war of attrition against Iraq.



BuAer no. 159228 is a twin-engined AH-1J SeaCobra of the US Marine Corps, with the powerful General Electric M197 gun. It is seen on special trials at the Naval Weapons Center, China Lake, California, in March 1980. It was engaged in trials with AIM-9L Sidewinder self-defence AAMs, which were fired against target RPVs.

duction. The US Army was still trying to achieve success with the extremely complex Lockheed AH-56A Cheyenne, but it saw in the Cobra something it could get to Vietnam quickly. Little did Bell know the very advanced Cheyenne would grind to a halt, and the Cobra would have the gunship market to itself for the next 18 years!

A wealth of possible equipment and armament fits was eventually produced for the HueyCobra, the first being Emerson's TAT-102A turret fixed under the nose and fitted with two 7.62-mm (0.3-in) machine-guns or six-barrel Miniguns. The more common installation became the M28 armament system comprising either two Miniguns, two M129 40-mm grenade-launchers each with 300 projectiles, or one of each. On stub wings could be hung four launchers for 76 rockets, or pods of larger rockets, or Miniguns or 30-mm cannon, or, in later years, the quadruple TOW missile installation, with the Hughes stabilized sight in the nose. Over the years in Vietnam the HueyCobra became more commonly known as the Snake, working in partnership with the Loach (OH-6A Cayuse) to form a deadly front-line team that for the first time used the helicopter as a true front-line battle weapon.

Deliveries of the original AH-1G reached 1,126 by late 1971. The US Marine Corps bought the AH-1J SeaCobra, which used the 1,800-shp (1343-kW) PT6T (T400) coupled twin turbine. This Canadian engine was also selected at the same time for a regular Huey version, the UH-1N (Canadian CH-135), the first members of the Model 212 or Twin Two-Twelve family. Should either power section fail, the remaining half can be instantly uprated to over 1,000 shp (746 kW), giving full twin-engine safety. The SeaCobra was later developed into today's AH-1T, with a longer body, more power, uprated dynamic parts and TOW or Hellfire missiles. Like all the latest Cobras the chin turret is fitted with the M197 20-mm gun, which has three of the six barrels of the M61 fighter aircraft gun. Since 1980 Bell has been flying an AH-1T with two General Electric T700 engines giving a combined power of 3,380 hp (2521 kW). This is expected to become the standard power of future Cobras, which are strengthened to take it, along with many refinements to enable them to survive even better in the face of hostile fire. Meanwhile, by 1983 the US Army had completely rebuilt its Cobras to bring over 1,000 up to various AH-1S standards with largely new structure and systems, angular flat-plate canopies, a single T53 uprated to 1,800 shp (1343 kW), and completely upgraded avionics and weapons.

Revised Model 212

Large numbers of Twin Two-Twelves are in use all over the world in both military and civil roles. One batch of 10, with extremely full equipment, was supplied to China to support energy and natural resource development. In August 1979 flight development began of the Model 412, a Model 212 with an advanced four-blade main rotor which improves performance whilst reducing noise and vibration. It is selling well in military and civil forms, and is also being built by Agusta as the AB.412, with the emphasis on multi-role military variants.

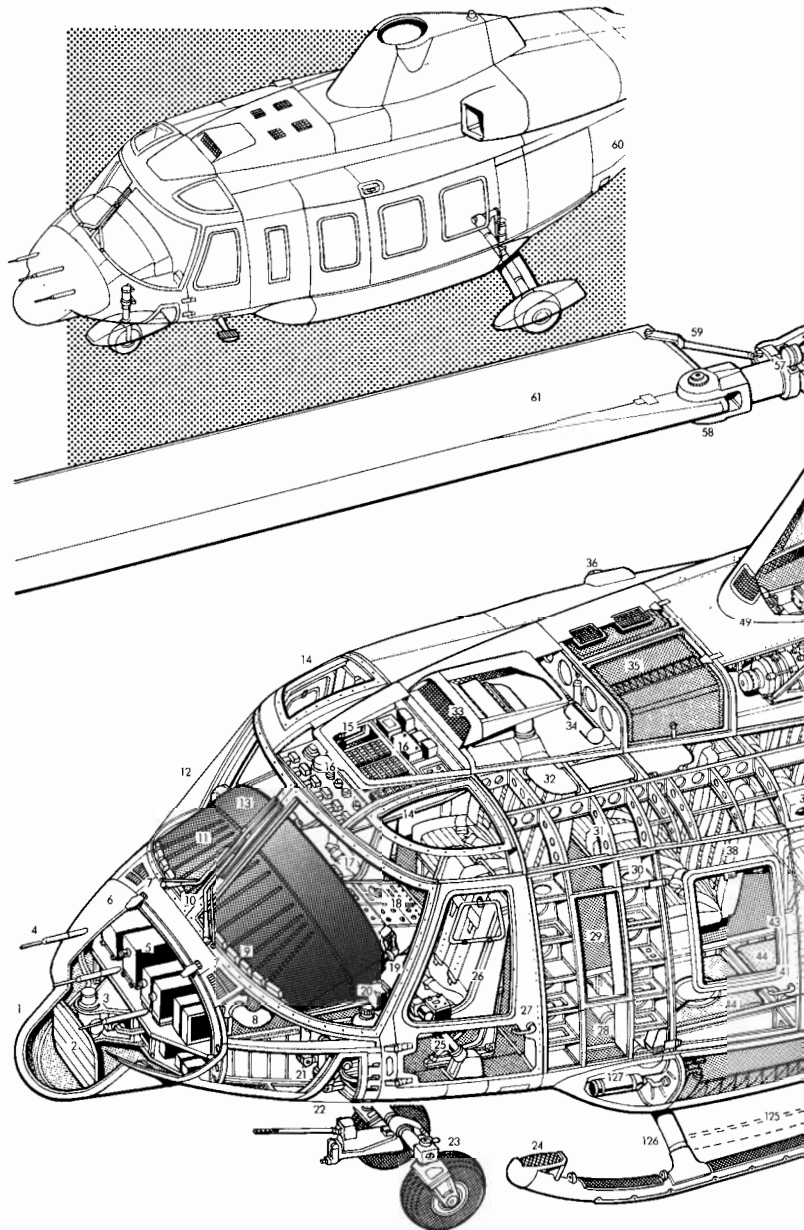
A move towards further increase in basic capability came in 1967 with the HueyTug, powered by a Lycoming T55 rated at 2,650 shp



The Model 212 Twin Two-Twelve has almost the same structure as the UH-1H and related models, but is powered by the PT6T-3B engine which has two separate power sections, giving twin-engine safety. The Twin Two-Twelve commercial version, as seen here, was certificated in 1970 to carry a 5,000-lb (2268-kg) load.

(1977 kW), reduced to a steady 2,000 shp (1492 kW) to match the limit of the transmission to the Model 540 door-hinge rotor. This led to the KingCobra gunship, not built in numbers, and the Model 214 HueyPlus, with the 2,850-shp (2126 kW) T55. Iran under the Shah snapped up 287 Advanced 214As, one of which soon set world class records for altitude and rate of climb. This in turn led to a batch of Model 214B BigLifters, leading to today's Model 214ST, the suffix meaning Stretched Twin. Today the top end of the entire Huey range, this great machine looks good with its larger and more streamlined fuselage, on top of which is the power package containing two General Electric CT7-2A engines of 1,625 shp (1212 kW) each. They drive a new transmission and rotor system, the main rotor having very advanced glassfibre blades of 52-ft (15.85-m) diameter, good enough for gross weights up to 17,500 lb (7938 kW) and with the ability to hoist slung loads up to 9,000 lb (4082 kg), or getting on for double the laden weight of the original XH-40! In offshore operations, where the passengers are extremely weighty, it is still possible to fly a pilot, co-pilot and 18 passengers over sectors exceeding 400 miles (644 km).

Today Bell Helicopter has so many products and so many new projects that the Huey is just one of a wide range of product lines. But it is very doubtful any of these will rival the total numbers of Hueys, and they have some way to go yet. Even the old Model 205 has had to be put back on the line to fulfil an order for 25 for Turkey; and Fuji and Agusta are still hard at it, while Bell concentrates on the latest Cobras, Model 412s and Model 214s.

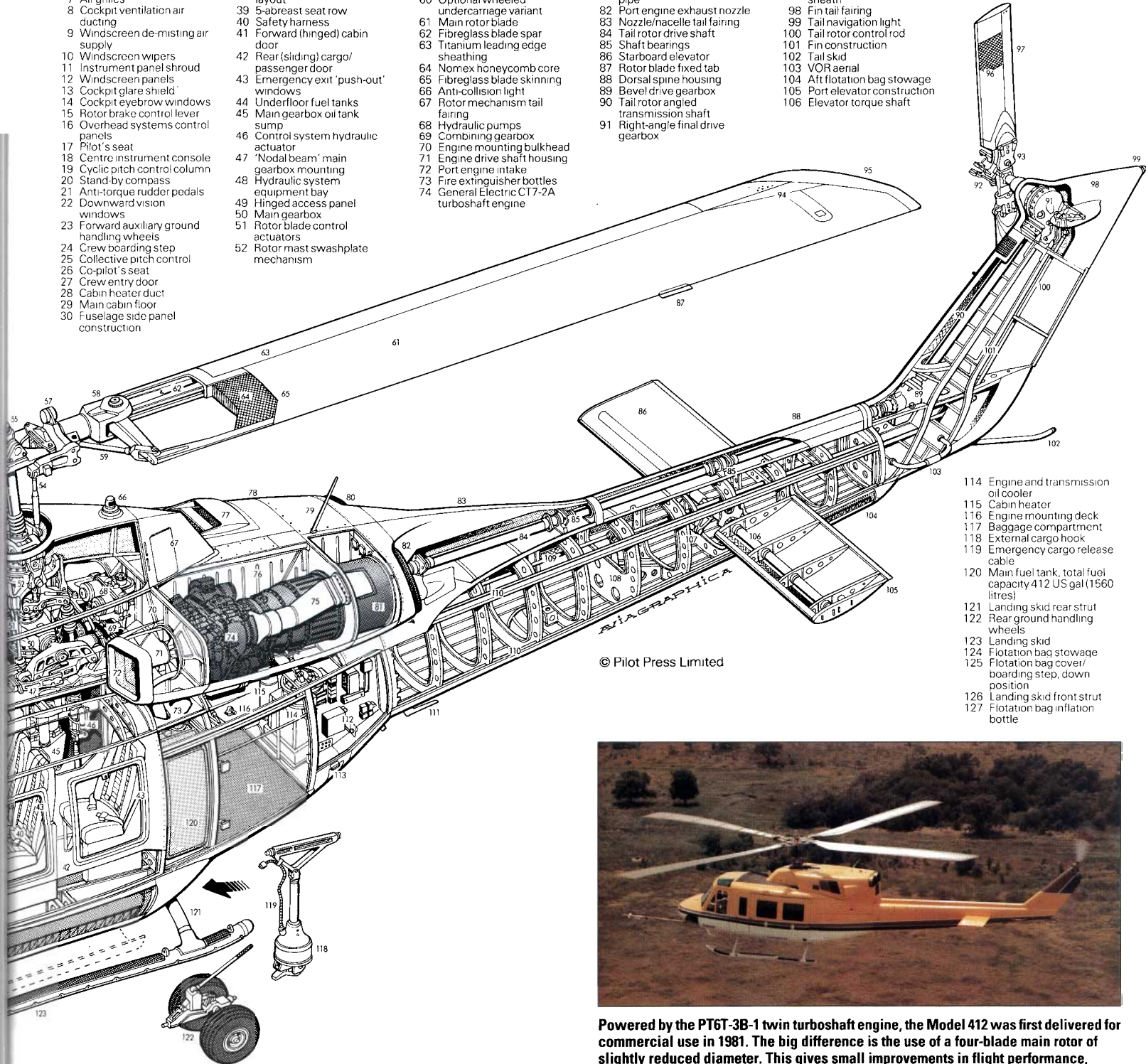


Biggest, most capable and easily the most powerful of the entire Huey family, the Model 214ST is powered by two General Electric CT7-2A engines totalling 3,250 hp (2423 kW). British Caledonian use this and two sister-ships for offshore oil support in the North Sea. After delivery to the airline the skid landing gear was replaced by wheels.



Bell 214ST cutaway drawing key

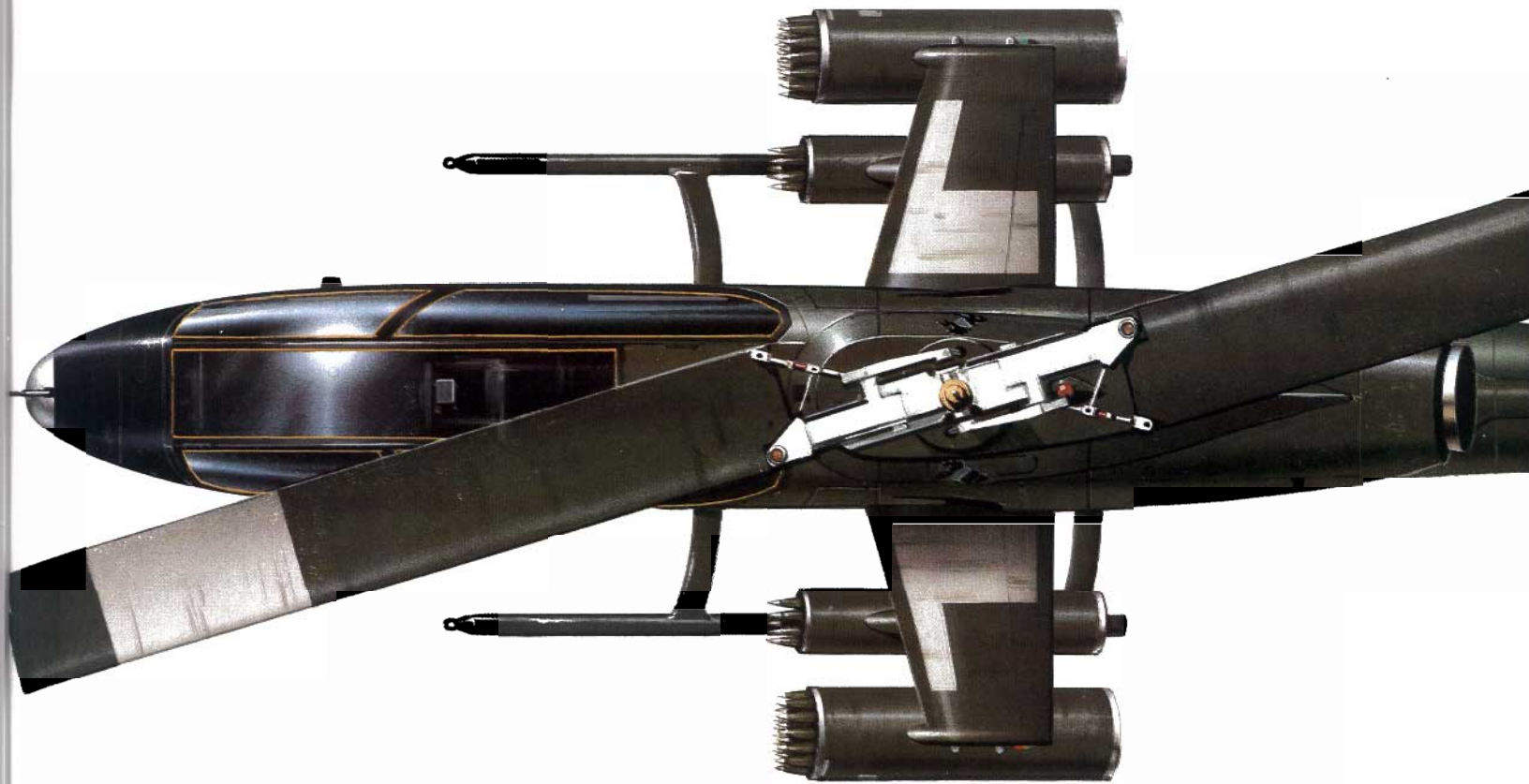
- | | | | | | |
|---|--|--|---|--|------------------------------|
| 1 Radome | 31 Cabin roof framing | 53 Main rotor drive shaft | 75 Intake particle separator | 92 Tail rotor hub pitch control | 107 Hydraulic actuator |
| 2 Weather radar scanner | 32 Ventilation air ducting | 54 Blade pitch control rods | 76 Engine bay dividing firewall | 93 Blade attachment joints | 108 Tailboom construction |
| 3 Radar tracking mechanism | 33 Fresh air intake | 55 Pivoted rotor head mounting | 77 Cooling air scoop | 94 Main rotor blade balance weight pocket | 109 Tail rotor control rod |
| 4 Pitot tubes | 34 Life raft inflation bottles | 56 Semi-rigid rotor hub plate | 78 Detachable engine cowlings | 95 Swept blade tips | 110 Main longerons |
| 5 Radio and electronics equipment bay | 35 Two 12-man life rafts | 57 Blade counterweights | 79 VHF aerial | 96 Honeycomb tail rotor blade construction | 111 UHF aerial |
| 6 Hinged nose compartment access door | 36 Starboard navigation light | 58 Blade root fork and fixing | 80 Starboard engine exhaust | 97 Titanium leading edge sheath | 112 Electrical equipment bay |
| 7 Air grilles | 37 Port navigation light | 59 Fixed drag strut | 81 Heat shrouded exhaust pipe | 98 Fin tail fairing | 113 Ground power socket |
| 8 Cockpit ventilation air ducting | 38 Passenger seating, 16-seat layout | 60 Optional wheeled undercarriage variant | 82 Port engine exhaust nozzle | 99 Tail navigation light | |
| 9 Windscreen de-misting air supply | 39 5-abreast seat row | 61 Main rotor blade | 83 Nozzle/macelle tail fairing | 100 Tail rotor control rod | |
| 10 Windscreen wipers | 40 Safety harness | 62 Fibreglass blade spar | 84 Tail rotor drive shaft | 101 Fin construction | |
| 11 Instrument panel shroud | 41 Forward (hinged) cabin door | 63 Titanium leading edge sheathing | 85 Shaft bearings | 102 Tail skid | |
| 12 Windscreen panels | 42 Rear (sliding) cargo/passenger door | 64 Nomex honeycomb core | 86 Starboard elevator | 103 VOR aerial | |
| 13 Cockpit glare shield | 43 Emergency exit 'push-out' windows | 65 Fibreglass blade skinning | 87 Rotor blade fixed tab | 104 Aft flotation bag stowage | |
| 14 Cockpit eyebrow windows | 44 Underfloor fuel tanks | 66 Anti-collision light | 88 Dorsal spine housing | 105 Port elevator construction | |
| 15 Rotor brake control lever | 45 Main gearbox oil tank sump | 67 Rotor mechanism tail fairing | 89 Bevel drive gearbox | 106 Elevator torque shaft | |
| 16 Overhead systems control panels | 46 Control system hydraulic actuator | 68 Hydraulic pumps | 90 Tail rotor angled transmission shaft | | |
| 17 Pilot's seat | 47 'Nodal beam' main gearbox mounting | 69 Combining gearbox | 91 Right-angle final drive gearbox | | |
| 18 Centre instrument console | 48 Hydraulic system equipment bay | 70 Engine mounting bulkhead | | | |
| 19 Cyclic pitch control column | 49 Hinged access panel | 71 Engine drive shaft housing | | | |
| 20 Stand-by compass | 50 Main gearbox | 72 Port engine intake | | | |
| 21 Anti-torque rudder pedals | 51 Rotor blade control actuators | 73 Fire extinguisher bottles | | | |
| 22 Downward vision windows | 52 Rotor mast washplate mechanism | 74 General Electric CT7-2A turboshaft engine | | | |
| 23 Forward auxiliary ground handling wheels | | | | | |
| 24 Crew boarding step | | | | | |
| 25 Collective pitch control | | | | | |
| 26 Co-pilot's seat | | | | | |
| 27 Crew entry door | | | | | |
| 28 Cabin heater duct | | | | | |
| 29 Main cabin floor | | | | | |
| 30 Fuselage side panel construction | | | | | |



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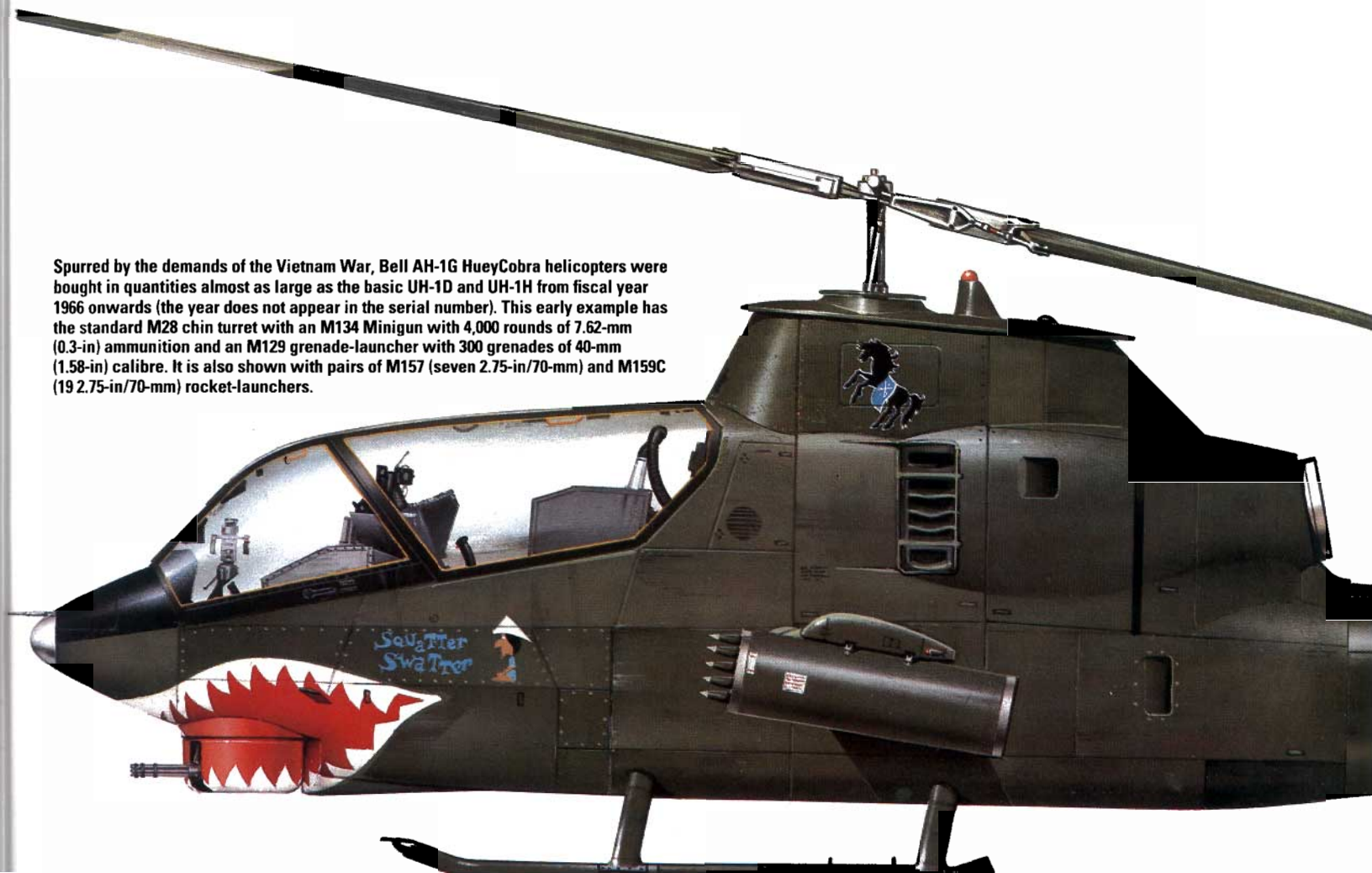


Powered by the PT6T-3B-1 twin turboshaft engine, the Model 412 was first delivered for commercial use in 1981. The big difference is the use of a four-blade main rotor of slightly reduced diameter. This gives small improvements in flight performance, notably in rate of climb, but the big advantage is less vibration.



Bell Model 209

Spurred by the demands of the Vietnam War, Bell AH-1G HueyCobra helicopters were bought in quantities almost as large as the basic UH-1D and UH-1H from fiscal year 1966 onwards (the year does not appear in the serial number). This early example has the standard M28 chin turret with an M134 Minigun with 4,000 rounds of 7.62-mm (0.3-in) ammunition and an M129 grenade-launcher with 300 grenades of 40-mm (1.58-in) calibre. It is also shown with pairs of M157 (seven 2.75-in/70-mm) and M159C (19 2.75-in/70-mm) rocket-launchers.



Specification

Bell Model 209 AH-1S

Type: anti-armour attack helicopter

Powerplant: one 1,800-shp (1343-ekW) Avco Lycoming T53-703 turboshaft

Performance: maximum speed varies from 207 mph (333 km/h) to 141 mph (227 km/h) depending on equipment fit; range at sea level with maximum fuel and eight per cent reserves 315 miles (507 km)

Weights: empty 5,479 lb (2939 kg); maximum take-off 10,000 lb (4535 kg)

Dimensions: main rotor diameter 44 ft 0 in (13.41 m) or, in AH-1T family, 48 ft 0 in (14.63 m); fuselage length 44 ft 7 in (13.59 m) or, in AH-1T, 48 ft 2 in (14.68 m); height over tail rotor 13 ft 6½ in (4.12 m); main rotor disc area 1,520.5 sq ft (141.26 m²) or, in AH-1T, 1,809.6 sq ft (168.1 m²)

Armament: eight TOW missiles on outboard wing pylons, with pods inboard housing groups of seven or 19 of any of five types of 2.75-in (69.9-mm) rocket; General Electric turret under nose with M197 20-mm three-barrel gun (alternatives are 30-mm gun or combined 7.62-mm/0.3-in Minigun plus 40-mm grenade-launcher)

Bell Huey variants

Model 204 (XH-40): three prototypes (55-4459/61)

YH-40: improved development machines (56-6723/28)

UH-1A: initial production with 770-shp (547-kW) T53-1A, later 960-shp (716-kW) T53-5; total 182

TH-1A: dual trainer variant, total 14

UH-1B: stretched model with nine seats, 1,100-shp (821-kW) T53-11, new main rotor, often armed (same designation); total 1,014

UH-1C: revised fuel tankage with greater capacity and improved cabin, new Type 540 rotor; total 767

UH-1D: further enlarged cabin, T53-11 engine; total 2,008, plus various exports and 352 licence-built by Dornier

UH-1E: armed assault model for US Marines with T53-11 and (retrofit) Type 540 rotor, total 192

TH-1E: dual trainer; total 20

UH-1F: USAF ICBM site support model with 1,272-shp (949-kW) T58-3 engine and 11 seats; total 120

TH-1F: USAF trainer; total 26

AH-1G: first HueyCobra; total 1,119

TH-1G: dual trainer conversions

UH-1H: UH-1D with 1,400-shp (1044-kW) T53-13; total 5,435 plus exports and 118 built in Taiwan

EH-1H: ECM/EI/Int conversions of UH-1H

HH-1H: base rescue USAF model; total 30

AH-1J: basic SeaCobra; total 84 plus 202 for Iran

HH-1K: US Navy search/rescue; total 27

TH-1L: US Navy trainer; total 90

UH-1L: US Navy utility; total 8

UH-1M: US Army night attack conversions

UH-1N: twin Two-Twelve utility model with up to 15 seats; total USAF 79, US Navy/Marines 221

VH-1N: US Marine VIP transports; some conversions plus new-build; total 6

UH-1P: psy-war conversions of UH-1F, unknown number

AH-1Q: improved rebuilds of AH-1G

AH-1R: uprated AH-1G (1,800-shp/1343-kW T53-703) conversions

AH-1S: series of progressive improvements of AH-1G, plus new build; total (excluding conversions) 396 plus 54 for JGSDf licence-building by Fuji

AH-1T: latest SeaCobra, 2,050-shp (1529-kW) T400-WV-402 twin engine; total 57 so far, with production now resuming at 22 per year 1984-86

Model 204: basic commercial model corresponding to UH-1B; total not published but includes over 840 built by overseas licensees

Model 205: basic commercial counterpart of UH-1H; total not published but including military models (UH-1D and H) exceeds 10,000

Model 212: basic commercial counterpart of UH-1N; total not published but well over 100 sold by Agusta and in production by that company and Bell

Model 412: new product line with four-blade main rotor, otherwise based on Twin Two-Twelve; total (mid-1983) about 120 plus 50+ by Agusta including latter's multi-role AB 412 Grifone

Model 214: family of much more powerful and larger machines, first production model being Model 214A (287 for Iran) and AB 214B by Agusta; current Bell version is Model 214ST, produced at three per month since mid-1982

