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Leonardo NextGenCTR

Outlook

- The NextGenCTR project is part of the EU's Clean Sky 2 joint technology initiative
- First flight of a NextGenCTR demonstrator is planned for 2023

Orientation

Description. Twin-turboshaft-engine partial-tiltwing aircraft.

Sponsor. The Next Generation Civil Tiltrotor (NextGenCTR, or NGCTR) project is sponsored by Leonardo Helicopters.

Status. Concept design and development.

Total Produced. Not applicable.

Application. Short-range regional passenger transportation, business/executive transportation, offshore oil operations, small package express, cargo transportation, and charter freight. Possible military applications include troop transport, anti-submarine warfare, and search-and-rescue.

Price Range. The cost of full-scale development has been estimated at EUR1.0 billion (\$1.14 billion).

Contractors

Prime

Leonardo Helicopters, Cascina Costa

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Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

Design Features. The NextGenCTR project builds on earlier work conducted on the Enhanced Rotorcraft Innovative Concept Achievement (ERICA) design. The NextGenCTR concept involves a partial-tiltwing aircraft

powered by two unspecified turboshaft engines in the 3,000-shp class. The aircraft is equipped with a fly-by-wire flight control system.

Leonardo NextGenCTR

The engines are fixed in a horizontal position; only the gearboxes and four-blade proprotors rotate (or tilt) as the aircraft transitions from forward to vertical flight. A nacelle is mounted at each end of the aircraft's wing. Each nacelle integrates an engine and a tilting gearbox in a streamlined configuration.

The NextGenCTR is a partial-tiltwing design: only the outer wing sections, inboard of the engine nacelles, tilt. The tilt of the wing is not fixed or synchronized to the

tilt of the proprotors. The aircraft incorporates a V-tail with moving ruddervators.

The seating capacity of the eventual production aircraft has not yet been finalized, but will likely be around 20 passengers. Cruise speed will be greater than 510 km/h (275 kt).

The NextGenCTR project was formerly known as the Second Generation Civil Tiltrotor (Gen2CTR).

Program Review

Background. In September 1986, six European aerospace companies signed an agreement to collaborate on a preliminary concept definition study for a commercial tiltrotor aircraft. This program was called the European Future Advanced Rotorcraft (EUROFAR) program.

The six firms were Aerospatiale, Agusta, MBB, Westland, Aeritalia, and CASA. The first four had previously conducted individual studies on the tiltrotor concept. In September 1987, approval was granted for the EUROFAR effort to receive funding from the European EUREKA research and development program.

The initial phase of the EUROFAR program began in 1987. This phase defined the baseline aircraft, determined marketability and infrastructure requirements, and evaluated how a tiltrotor would fit the European civilian air transportation market. The phase was completed in 1991.

The second phase of the program began in February 1993. This phase covered system consolidation and detailed definition of a demonstrator vehicle.

EUROFAR Consortium. The six original members of the EUROFAR consortium all participated in the feasibility study that constituted the first phase of the program. However, by early 1993, when the second phase of the program began, the make-up of the consortium had changed considerably. Aeritalia (which had been merged into Alenia), Agusta, and CASA chose not to participate in phase two. Financial reasons accounted for the decisions of Agusta and CASA. Meanwhile, the helicopter divisions of Aerospatiale and MBB had been merged into Eurocopter. Thus, the consortium then consisted of Eurocopter, Aerospatiale, and Westland. Shares in the program were as follows: Eurocopter France and Aerospatiale, 46 percent; Eurocopter Deutschland, 22 percent; and Westland, 32 percent.

In late 1997, Agusta rejoined the EUROFAR studies.

Design Considerations. Originally, EUROFAR was intended to be in the 9,979-10,886 kilogram (22,000-24,000 lb) class and carry 19-25 passengers. However, the aircraft design grew substantially in weight and capacity.

The eventual EUROFAR high-density version was intended to carry up to 30 passengers. The aircraft would have had a cruise speed of 335 knots and a range of 664 nautical miles. Maximum takeoff weight was 13,650 kilograms (30,093 lb).

A modified version of the Pratt & Whitney Canada PW300 had been expected to be the aircraft's powerplant. However, final selection of an engine never did occur.

As part of the EUROFAR program's second phase, the consortium began preliminary work on a six-tonne (13,228-lb) demonstrator aircraft to be powered by Rolls-Royce Turbomeca RTM322 powerplants. The consortium also began evaluating the market potential for a tiltrotor in the 6-tonne class. A later program proposal called for a demonstrator in the 6- to 8-tonne class.

Eurotilt. The EUROFAR program ended in the first half of 1999. Earlier in the year, Agusta and Westland had withdrawn from the program in favor of developing a compound helicopter. Eurocopter had already been looking for other European companies to invest in the tiltrotor project. By mid-1999, a Eurocopter-led consortium comprising 33 companies from nine European nations was established to develop a new tiltrotor aircraft called Eurotilt.

Eurotilt was to have been a 12-19 seat tiltrotor aircraft in the 10,000-kilogram (22,046-lb) weight class. It was to be powered by two RTM322 turboshaft engines rated 1,566 kW (2,100 shp) each. The engines would remain fixed, and the rotors and part of the transmission would transition during flight. Eurotilt would use fly-by-wire flight control technology derived from the NH90 helicopter.

Leonardo NextGenCTR

2 Gether Too Costly

The EC refused to provide funding for the 2 Gether program. It rejected the program as being too costly and not sufficiently innovative. The companies were asked to devise a more integrated response.

New Proposal

In March 2001, Eurocopter and the newly formed AgustaWestland submitted a new tiltrotor proposal to the EC. For this program, the companies began focusing on a 19-22 passenger, partial-tiltwing aircraft that assumed the ERICA name. The European Union funded concept development work. The new ERICA concept was derived from the earlier Agusta ERICA design.

ERICA was envisioned primarily as a civil aircraft, but military applications were possible. The aircraft had a double-bubble fuselage, and would have been equipped with twin turboshaft engines (conceptually, growth versions of the Pratt & Whitney Canada PW125), 7.4-meter (24.3-ft) diameter four-blade rotors, and fly-by-wire flight controls. The ERICA design had outer wing sections that would rotate along with wingtip-mounted nacelles and proprotors. The outer wing sections could also be moved independently of the nacelles.

ERICA would have weighed approximately 10,000 kilograms (22,046 lb). Cruise speed would have been 650 km/h (350 kt).

In January 2014, Eurocopter was renamed Airbus Helicopters.

Besides AgustaWestland and Airbus Helicopters, other firms involved in ERICA included Aernnova, Liebherr-Aerospace Lindenberg, Mecaer, Secondo Mona, Selex ES, SENER, and ZF. Also involved were the research organizations CIRA, DLR, ONERA, NLR, and SICTA.

NICE-TRIP

Much of the work regarding the ERICA concept was carried out under the European Union's Novel Innovative Competitive Effective Tilt Rotor Integrated Project (NICE-TRIP). Jointly funded by industry and the EU, the NICE-TRIP effort began in November 2006 and was completed in November 2014.

Brussels-based VERTAIR, a European Economic Interest Grouping (EEIG), acted as project coordinator for the NICE-TRIP effort on behalf of its members AgustaWestland and Airbus Helicopters. Besides AgustaWestland, Airbus Helicopters, and VERTAIR, participants in NICE-TRIP included several European companies, research institutes, and universities.

Eurotilt was designed to replace helicopters in the Super Puma/Cougar class for missions over a range of 370-1,482 kilometers (200-800 nm) at a cruise speed of 556 km/h (300 kt) and a ceiling of 7,620 meters (25,000 ft).

In June 1999, the Eurotilt consortium submitted a bid to receive development funding from the European Commission (EC) for the Eurotilt program. The consortium planned initially to build a full-scale ground test rig that was estimated to cost \$87.5 million. The ground test project was expected to last four years. However, at the two-year mark, depending on the results of a mid-term review, the consortium intended to start work on a full-scale flight demonstrator.

The initial flight of the demonstrator was planned for the 2004-2005 timeframe, with certification and service entry by 2008.

Early ERICA Design

ERICA. Former EUROFAR participants Agusta and Westland also submitted a bid for EC funding for their compound helicopter project. In addition, both were members of a team of 16 companies that bid for EC funding for development of a 20-seat partial-tiltwing aircraft called ERICA (Enhanced Rotorcraft Innovative Concept Achievement). Agusta acted as leader of this team.

This early ERICA design was eventually refined into the later ERICA concept (see below).

2 Gether Program. In October 1999, the EC rejected both the Eurotilt and ERICA bids for funding. However, the EC said that its member states believed that the competitors should be given another chance if they submitted a single proposal.

Later that year, Eurocopter, Agusta, and Westland signed a Memorandum of Understanding confirming their intention to submit a proposal for a joint tiltrotor program to the EC. A joint proposal was submitted by the three companies in March 2000.

The proposed joint tiltrotor program, dubbed the 2 Gether program, was to have begun with a four-year research effort, estimated to cost \$96 million. Both the Eurotilt and ERICA concepts would have been studied during the research program. Two integration rigs would have been built for the evaluation of various technologies. At the end of the four-year research effort, a decision would have been made as to which concept would be further pursued. A demonstrator would have been built; its initial flight was planned for 2005. A development program was to follow. Series production was scheduled to begin in 2010.

Leonardo NextGenCTR

The main program objectives of NICE-TRIP were: to validate the European civil tiltrotor concept based on the ERICA architecture; to validate critical technologies and systems through development, integration, and testing of tiltrotor aircraft components on full-scale dedicated rigs; to develop and test wind tunnel models; to evaluate the potential introduction of tiltrotors into the European Air Traffic Management System; and to assess the sustainability of the tiltrotor aircraft with respect to social and environmental issues and define a path toward manufacture of a future tiltrotor flight demonstrator.

Project Zero

In March 2013, AgustaWestland unveiled its Project Zero all-electric tiltrotor technology demonstrator. The Project Zero program was funded entirely by AgustaWestland. The demonstrator is completely electric-powered, and performed an initial unmanned tethered flight in June 2011. It later performed a number of untethered hovering flights. None of the flights were publicly announced at the time they were made. The demonstrator can be flown as a manned

aircraft, though no plans exist to do so as the aircraft is intended for use solely for the purposes of technology development.

A number of companies from Italy, Japan, and the U.S. supplied components for, and/or contributed design expertise to, the Project Zero effort. The Project Zero demonstrator's rotors are driven by electric motors powered by rechargeable batteries. Plans call for the aircraft to be fitted in the future with a diesel engine that would act as a generator feeding the batteries. The electric motors would continue to turn the rotor blades.

Corporate Rebranding

In early 2016, AgustaWestland's activities were absorbed into the newly formed Helicopters Division of Leonardo-Finmeccanica SpA. The move was part of a corporate restructuring and rebranding, which involved AgustaWestland's parent firm Finmeccanica taking the interim moniker Leonardo-Finmeccanica. In January 2017, Leonardo-Finmeccanica was renamed Leonardo SpA.

Funding

The NextGenCTR effort is part of the European Union's Clean Sky 2 joint technology initiative. The Clean Sky 2 budget for the NextGenCTR project is approximately EUR254 million (\$290 million). Plans call for the EU to fund approximately EUR127 million (\$145 million) of this total, with private industry contributing the remainder.

Additional funding would be necessary outside the auspices of Clean Sky 2 in order to cover the full scope of the NextGenCTR program.

Total cost of the NICE-TRIP effort was EUR35.5 million, of which the EU contributed EUR19 million and private industry contributed the remainder.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Sep	1986	Collaboration agreement signed by six European aerospace firms
Sep	1987	EUREKA funding approved for EUROFAR program
Dec	1991	Phase one feasibility study completed
Feb	1993	Phase two of EUROFAR program begun
Early	1999	EUROFAR program ended; Eurotilt consortium established
Late	1999	Eurocopter, Agusta, and Westland teamed on 2 Gether program
Early	2001	Eurocopter and AgustaWestland devise new joint concept
Nov	2006	EC-funded NICE-TRIP program begun
Jun	2011	First unmanned tethered flight of Project Zero demonstrator
Nov	2014	NICE-TRIP program completed
	2023	Planned first flight of NextGenCTR scaled demonstrator

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Progress continues on the Leonardo-led effort to develop the Next Generation Civil Tiltrotor (NextGenCTR). Much of the work on the NextGenCTR project is carried out under the auspices of the Fast Rotorcraft program of the European Union's Clean Sky 2 joint technology initiative.

Program plans call for a NextGenCTR scaled demonstrator to fly for the first time in 2023. The wing for the demonstrator is being developed by the T-WING consortium, which was selected in September 2017 for this task. The consortium is coordinated by the Italian aerospace research organization CIRA, and includes

Magnaghi Aeronautica, Officine Meccaniche Iripine, Salver SpA, SSM, the German firm IBK-Innovation, and the engineering department of the University of Naples Federico II. The wing is to be built of composite material with titanium alloy joints.

The NextGenCTR demonstrator is to be somewhat smaller than an eventual production aircraft. A production model could appear in 2030 or shortly thereafter. Its size has not yet been determined, pending evaluation of a business case. However, it would likely have seating capacity for approximately 20 passengers.

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