

# EuroProp International TP400

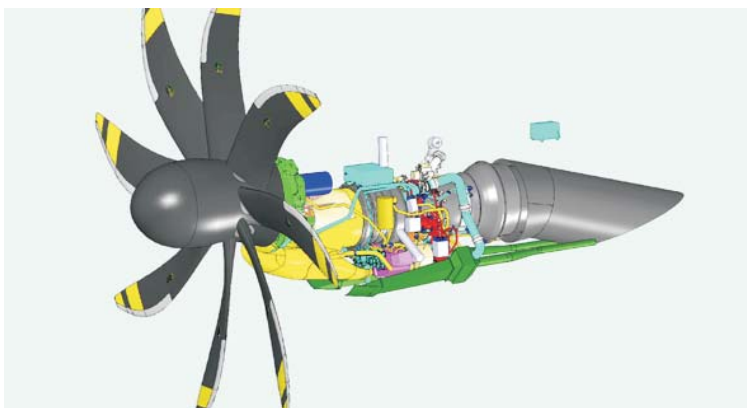
Section: Turboprops  
December 2005

## Program Briefing

The TP400 is a three-shaft turboprop rated at 11,000 shp. The only variant is the -D6 which is currently in development to power the four-engine Airbus A400M military transport. The first flight for the A400M is anticipated in 2007.

EuroProp International (EPI) is made up of four European engine manufacturers. Rolls-Royce, MTU and Snecma have 28% share in the program and ITP of Spain has 16%. Avio of Italy is a revenue sharing partner in ITP's stake. Workshares are based on each country's A400M procurement. Snecma has 32%, Rolls-Royce 25%, MTU 22%, and ITP 21%.

Teal Group projects 326 units produced by the EPI consortium in the next 10 years with a total value of around \$1.3 billion.



### Quick Specs:

Power Class:	11,000 shp	8,200 kW
Pressure Ratio:	25:1	
Airflow:	n/a	
SFC:	n/a	
Configuration:	1 P; 5 IPC; 6 HPC; 1 Annular; 1 HPT; 1; IPT; 3 LPT	

## Manufacturers

### EuroProp International GmbH

Parque Empresarial San Fernando de Henares, Madrid, Spain (headquarters)  
Ludwigsfelde, Germany (final assembly)

### Partners in EPI

Industria de Turbo Propulsores SA  
Parque Tecnologico  
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Spain  
tel: +34-9-4466-2100  
fax: +34-9-4466-2193  
email: itp@itp.es  
website: www.itp.es  
(16% share in EPI)

MTU Aero Engines GmbH  
Dachauer Str. 665  
D-80995 Munich  
Germany  
tel: +49-89-1489-0  
fax: +49-89-1489-5500  
email: info@muc.mtu.de  
website: www.mtu.de  
(28% share in EPI)

Rolls-Royce plc  
Defence Aerospace  
P.O.Box 3  
Filton, Bristol  
England BS12 7QE  
tel: +44 117-9791234  
fax: +44 117-9798005  
website: www.rolls-royce.com  
(28% share in EPI)

## Summary Forecast

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Units Produced	3	6	—	—	10	46	60	67	67	67	326
Value (2005 \$Millions)	12.0	24.0	—	—	40.0	184.0	240.0	268.0	268.0	268.0	1,304.0

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*(28% share in EPI)*

## Responsibilities

### ITP

- Front frame
- Power turbine
- Turbine exit casing and nozzle
- External dressings
- Test equipment and aircraft assembly line support
- Integrated logistic support

### MTU

- Intermediate-pressure compressor
- Intermediate turbine
- Intermediate shaft
- Engine control system (with Snecma)
- Final assembly

- Integrated logistic support

### Rolls-Royce

- High-pressure compressor
- Low-pressure shaft
- Intermediate casing
- Hot struts
- Internal gearbox
- Air/oil and heat management system
- Whole Engine Model
- Engine performance
- Integrated logistic support

### Snecma

- Combustor

- High-pressure turbine
- Powerplant installation on aircraft
- Lubrication system
- Starter
- Engine control system (with MTU)
- Accessory gearbox and components
- Integrated logistic support

### EPI

- Program management
- Overall engine integration
- Procurement of the power gearbox
- Type Certificate holder

## Subcontractors

- Avio: propeller gearbox
- ELDIM BV: HP turbine seal segments
- Hispano-Suiza: accessory gearboxes and power transmission shafts
- Ratier-Figeac SA (subs. Hamilton Standard): propellers
- Sofrance: fuel and oil filters
- Tech Aero: lubrication system

## Technical Description

### Components

#### Layout

Three-spool turboprop. HP spool is contra-rotating to IP spool.

#### Propeller

Single 5.33-meter, eight-bladed propeller; fully reversing. Driven by the LP turbine. The blades are of variable pitch design and spin at 840 rpm.

The propellers will be "handed" to reduce some of the technical risk of the design. The gearbox will handle

the extra machinery for the counter-rotating units.

#### IP Compressor

Five-stage intermediate stage compressor with no variable to reduce complexity. Lightweight design with four titanium blisk-rotors. The IPC is located at the interface to the nacelle and intake. Pressure ratio is 3.5:1.

#### HP Compressor

Six-stage compressor from the Snecma M88-2 engine. Pressure ratio is 7:1. Two variable stages. Ten percent air bleed capability.

#### Combustor

Single annular combustor from the M88-2 engine.

**HP Turbine**

Single-stage high-pressure turbine from the M88-2 engine driving the HP compressor.

**IP Turbine**

Single-stage intermediate-pressure turbine driving the IP compressor.

**LP Turbine**

Three-stage low-pressure turbine driving the power shaft.

**Other Components**

Propellor gearbox to be supplied by Avio. The engine is equipped with a dual channel electronic control unit.

**Variants**

**TP400-D1**—The initial version of the turbine proposed by APA, the turbine proved to be too heavy and consumed too much fuel.

**TP400-D6**—The base model for use on the Airbus A400M, the TP400-D6 will be rated at 11,000 shp. The aircraft will be equipped with two, "handed" engines on each wing which will direct the airflow down and between the turbines to reduce

complications associated with the installation of the four large turboprops.



Airbus A400M powered by TP400-D6

## Specifications

### (Imperial Units)

Model	Max. Cont. Rating (shp)	Pressure Ratio	Compressor Config.	Airflow (lb/sec)	Fuel Con.* (USgal/hr)	Width (in)	Length (in)	Weight (lb)
TP400-D6	11,000	25:1	1-5-6	n/a	490	n/a	138	4,026

### (Metric Units)

Model	Max. Cont. Rating (kW)	Pressure Ratio	Compressor Config.	Airflow (kg/sec)	Fuel Con.* (liters/hr)	Width (m)	Length (m)	Weight (kg)
TP400-D6	8,200	25:1	1-5-6	n/a	1,850	n/a	3.5	1,830

*\*\*tactical mission fuel consumption"*

## Applications

Engine	Aircraft	Engines per A/C
TP400-D6	Airbus A400M	4

## Marketing Data

### Costs

Teal Group estimates the price of a TP400 turboprop at around \$4 million in 2005 dollars.

### The Competition

No existing western turboprop competes in the TP400's power class. The Pratt & Whitney Canada PW180

proposal, based on the PW800 geared turbofan, would apparently be able to compete with the TP400 if developed.

A number of Russian turboprops that meet and exceed the TP400's power output are in operation.

## Milestones

### Date

May 7, 2003  
July 21, 2004  
Nov. 30, 2004  
May 31, 2005  
June 2005  
Oct. 28, 2005  
Dec. 21, 2005  
October 2007  
November 2007  
August 2009

### Milestone

TP400 selected for A400M  
preliminary design review concluded  
intermediate pressure compressor stage makes first run in Munich (MTU)  
first test of engine control and monitoring system  
assembly of first engine commences  
successful first engine test  
first test series completed  
certification of first engine planned  
first flight of A400M planned  
delivery of first production engines to Airbus

## Program Overview

### Background

#### APA Formed

The TP400 turbine program is a microcosm of the European model of progress: Years of debate, bickering about market share, a false start, more debate, some last-minute backroom dealing and, incredibly, a viable product. Not totally unlike the conception of the Euro.

Initially proposed as a replacement from the Transall C-160 transport, the Airbus A400M project gained more urgency with the strong performance of "Strategic Airlift" during the 1991 Iraq war.

An initial consortium named Aero Propulsion Alliance (APA) was formed by Avio (8%), ITP (13.6%),

MTU (24.8%), Rolls-Royce (24.8%), Snecma (24.8%) and Techspace Aero (4%) was formed after initial proposals from BMW Rolls-Royce (BR700TP) and a Snecma-led group (M138 based on M88-2) went nowhere. The new consortium predictably merged the two designs and proposed the TP400-D1.

As could be expected from a slapped together design, the turbine was over-weight and not very efficient, so everyone eventually went back to the drawing board and a new RFP was issued.

### EPI Takes Over

A new consortium was formed with Rolls-Royce, MTU and Snecma each holding 28% shares and ITP holding the remaining 16% and they proposed the reworked TP400-D6 variant.

The work shares differ from EPI ownership shares and more reflect the number of A400Ms to be purchased by each country: Snecma, 35% (covering France, Belgium and Luxembourg); Rolls-Royce, 25% (UK and

Germany); MTU, 22% (Germany); and ITP, 21% (Spain and Turkey).

The main competition was the Pratt & Whitney Canada PW180 turboprop based on the PW800 geared turbofan. To make the project more appealing for European decision makers, P&WC offered to give a substantial work share to European contractors.

### TP400 Selected for A400M

Despite comments by Airbus that the P&WC proposal was 20% cheaper, the TP400 was finally selected by a contentious decision that didn't do much for trans-Atlantic relations.

Work share on the TP400 engine is split based on the number of aircraft purchased by each of the the partner

nations. The current shares are: Snecma 32.2% (including work at Techspace Aero), Rolls-Royce 25% (includes work at German operations), MTU 22.2%, ITP 20.6% (includes Turkish share).

### A400M Customers

The initial batch of 180 A400M aircraft are split in the following manner: Germany 60, France 50, Spain 27, UK 25, Turkey 10, Belgium 7, Luxembourg 1. Full production rate of the aircraft is expected to be around 30 a year.

Beyond sales to partner countries, Airbus hopes to sell around 200 aircraft (around 900 engines) to the export market. Potential customers include Australia, Malaysia, Norway, South Africa and Sweden.

### MRO

Logistical support for the turbine will be provided by EPI under the

same contract as the initial 750 turbine purchase.

### Current Developments

#### Status Report

EPI announced on July 21, 2004, that the preliminary design review of the engine had been completed. The intermediate pressure compressor made its first run at MTU's Munich facility.

The engine control and monitoring system (CMS) was first tested in late May 2005 at Snecma's Villaroche (near Paris) facility. The CMS includes the electronic control unit, the electronic protection and monitoring

unit, the fuel pump, the fuel metering unit, the fuel-cooled oil cooler, the high-pressure compressor variable stator vanes actuators, and the fuel filter.

Assembly of the first engine for ground testing began in June 2005.

#### First Engine Tests

EPI reported that on Oct. 28, 2005, the first TP400-D6 successfully completed its first test run. The event occurred at the MTU Maintenance Berlin-Brandenburg facility in

Ludwigsfelde, Germany. On December 21, it was announced that the first series of tests had been completed. During the tests, it was reported that the turboprop reached full power and completed more than 35 hours of testing.

#### Program Plans

Certification is planned for October 2007, and first flight is scheduled for November 2007. Deliveries of production engines to Airbus are scheduled for August 2009.

### Teal Group Evaluation

Like many other Euro-priorities, whether or not the A400M/TP400 are economic, commercial or military successes is besides the point. There has been too much blood spilled for the program to stop at this point. We think the aircraft does have an important role to fill, which probably could have been filled at a lower cost.

The number of export orders is up for debate and will depend on the final number of orders from the major part-

ners, but the stated EPI number of 200 seems a bit high, especially if one is counting on Malaysia to pick up a significant number of the expensive aircraft.

Nevertheless, the A400M will be cheaper than the C-17 and more capable than the C-130, leaving it as the only viable option for armed forces seeking instant "strategic projection" in their mission statements.

We don't see any other applications for the TP400 turboprop beyond future A400M variants. The engine core, however, may serve as the basis for future turbofan or turboshaft engines.

Teal Group projects 326 units produced by the EPI consortium in the next ten years with a total value of around \$1.3 billion.

## Production Forecast

Units	Thru 2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
<b>TP400-D6</b>												
development engines	—	3	6	—	—	—	—	—	—	—	—	9
A400M	—	—	—	—	—	10	46	60	67	67	67	317
<b>Total</b>	<b>—</b>	<b>3</b>	<b>6</b>	<b>—</b>	<b>—</b>	<b>10</b>	<b>46</b>	<b>60</b>	<b>67</b>	<b>67</b>	<b>67</b>	<b>326</b>
Value (2005 \$Millions)		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
<b>TP400-D6</b>												
development engines		12.0	24.0	—	—	—	—	—	—	—	—	36.0
A400M		—	—	—	—	40.0	184.0	240.0	268.0	268.0	268.0	1,268.0
<b>Total</b>		<b>12.0</b>	<b>24.0</b>	<b>—</b>	<b>—</b>	<b>40.0</b>	<b>184.0</b>	<b>240.0</b>	<b>268.0</b>	<b>268.0</b>	<b>268.0</b>	<b>1,304.0</b>