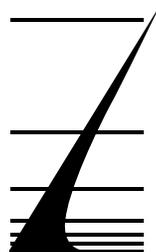


The Market for Missile/Drone/UAV Engines

Product Code #F655

A Special Focused Market Segment Analysis by:



FORECAST INTERNATIONAL

Analysis 5

The Market for Missile/Drone/UAV Engines 2010-2019

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* * *

PROGRAMS

The following reports are included in this section: (**Note:** a single report may cover several programs.)

HAL PTAE-7

Hamilton Sundstrand TJ-50/TJ-120 (Includes only TJ-120)

Microturbo TRI 40/TRI 60

Microturbo TRS 18

Mitsubishi TJM2/3/4

Teledyne J402

Turbomeca Arbizon

Williams International F107/F122/F415 (F107 Out of Production)

Williams International WR2/WR24 (Includes only WR24)

Introduction

Small turbine engine technology is generally leveraged from turbofan development programs. Advances in metallurgy allow higher operating temperatures and lower fuel consumption as well as greater durability. The combination of these advances in technology provides for changes in the tactics by the military, the largest user of UAVs.

Turbofan and turboprop-powered UAVs can loiter at altitudes that keep them out of enemy engagement range while giving battlefield commanders real-time surveillance information. This intelligence capability has made unmanned aircraft irreplaceable in the world's

militaries, and will guarantee their continuing development and production.

The small turbine engine industry's major players are Williams International, Microturbo, Teledyne, and Hamilton Sundstrand. All of these manufacturers produce turbofan or turbojet engines in the low thrust range for missile and UAV programs.

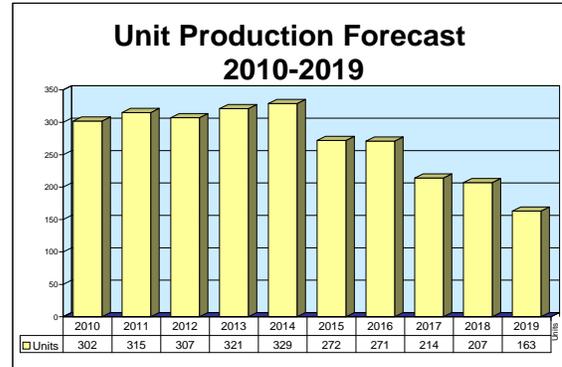
In this analysis, Forecast International reviews the world market for missile, drone, and UAV turbine engines. All known engine programs in production were reviewed in preparing this analysis, and an overview of the marketplace is provided.

* * *

Microturbo TRI 40/TRI 60

Outlook

- SCALP missile series popular in Europe
- TRI 40 replaces solid fuel engine on Exocet



Orientation

Description. Small, single-shaft, axial-flow turbojet series in the 750- to 1,250-lb class.

Sponsor. The Microturbo TRI 60 engine series was developed under contract by the Direction des Recherches et Moyens d'Essais, with funding directly from the government of France.

Licensees. Microturbo Ltd (formerly Ames Industrial Ltd), Fort Walling, Fareham, Hants, United Kingdom, and Microturbo Inc (formerly Microturbo North America), Grand Prairie, Texas, USA.

Application. Missiles, cruise missiles, drones, remotely piloted vehicles (RPVs), and other unmanned air vehicles (UAVs). Current or proposed applications include the following (all power ratings are at ISA sea-level conditions):

Power Class. Current series of powerplants: 750- to 1,250-lb class (3.36 to 5.56 kN).

Status. In production for Exocet, RBS15M Mk 2, Storm Shadow/SCALP missiles, and BQM-167A Skeeter.

Total Produced. As of August 2010, an estimated 6,197 TRI 40/TRI 60 engines of all variants were built.

<u>Engine Variant</u>	<u>Power or Thrust Rating</u>	<u>Application</u>	<u>Engines per Airframe</u>
TRI 40	560-750 lbst (2.5-3.3 kN)	Kongsberg/MBDA NSM	1
TRI 60	800-1,200 lbst (3.5-5.3 kN)	Saab TGA (potentially)	1
TRI 60-1	787 lbst (3.5 kN)	Meteor Mirach	
		300 RPV/Target	1
		Meteor Mirach 600 MAV	2
TRI 60-1 067	787 lbst (3.5 kN)	BAE Sea Eagle (P.3T)	
		Anti-ship Missile	1
TRI 60-2 071	832 lbst (3.7 kN)	Aerospatiale C.22	
		RPV/Drone	1
TRI 60-2 074	832 lbst (3.7 kN)	Beech MQM-107B Streaker	
		Missile Target	1
TRI 60-2 077	832 lbst (3.7 kN)	Saab RBS15M	
		Anti-ship Missile	1
TRI 60-2 080	832 lbst (3.7 kN)	HAL PTA Drone (early models)	1
TRI 60-2 088	832 lbst (3.7 kN)	Northrop NV-144/NV-151	
		drone (flight test units only)	1
TRI 60-2 089	832 lbst (3.7 kN)	Saab RBS15F/ASM15 Missile (air-launched)	1

Microturbo TRI 40/TRI 60

<u>Engine Variant</u>	<u>Power or Thrust Rating</u>	<u>Application</u>	<u>Engines per Airframe</u>
TRI 60-3 097	900 lbst (4.0 kN)	Beech BQM-126 drone	1
TRI 60-30	1,200 lbst (5.3 kN)	SCALP-EG (APACHE)	1
		Matra SCALP Navale	1
		MBDA Storm Shadow	1

Price Range. TRI 60 variants estimated at \$52,000 to \$83,000. TRI 40 estimated at \$100,000 (in 2010 U.S. dollars).

Competition. The TRI 40/60 faces competition from the 600- to 750-lbst (2.6- to 3.3-kN) Williams F107/112, the 800-lbst (3.5-kN) Turbomeca Arbizon, and the 640- to 1,100-lbst (2.8- to 4.8-kN) Teledyne CAE J402.

Contractors

Prime

Microturbo SA	http://www.microturbo.fr , 8, Chemin du Pont de Rupé, B.P. 2089, Toulouse, 31019 France, Tel: + 33 5 61 37 55 00, Fax: + 33 5 61 70 74 45, Prime
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Subcontractor

Pacific Scientific - ATG	http://www.pacsci.com , 4301 Kishwaukee St, PO Box 106, Rockford, IL 61105 United States, Tel: + 1 (815) 226-3100, Fax: + 1 (815) 226-3122, Email: customer_service@atg.pacsci.com (Alternator)
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Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to www.forecastinternational.com (see Products & Samples/Governments & Industries) or call + 1 (203) 426-0800.

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 Microturbo TRI 40/60 has the following design features:

Intake. Annular intake with bullet dome.

Compressor. A three-stage axial-flow compressor (four stages in TRI 60-20/30) gives a pressure ratio of 3.83:1 to 5.58:1. Light alloy aluminum wheels and stators are machined from drop-forged blanks.

The TRI 40 has a four-stage axial compressor.

Combustor. Annular smokeless combustor with 12 nozzles and a single spark or pyro-flare igniter, housed in a stainless-steel turbine case. Spray burners are fed

by a peripheral manifold. Mid-frame is fabricated from an investment casting and forging.

Turbine. Single axial-flow unit of IN718 drives the compressor through direct shaft coupling. Turbine inlet temperature (TIT) is approximately 1,850°F (1,010°C). Exhaust gases are exited via a convergent exhaust nozzle. Rear housing is cast and carries the rear main bearing, fuel manifold, injectors, and turbine casing.

Accessories. Starting can be accomplished by air motor, windmilling, or pyrotechnic cartridge, depending on the application. Electronic controls ensure speed governing and automatic sequencing when starting.

Dimensions. The approximate dimensions of the Microturbo TRI 60-2/-20/-30 and TRI 40 are as follows:

	<u>Metric Units</u>	<u>English Units</u>
TRI 60-2/-20/-30		
Length	749/851/851 mm	29.5/33.5/33.5 in
Diameter, maximum	330/348/348 mm	13.0/13.7/13.7 in
Weight	49/64.4/61.2 kg	108/142/135 lb

Microturbo TRI 40/TRI 60

	<u>Metric Units</u>	<u>English Units</u>
TRI 40		
Length	680 mm	26.77 in
Diameter, maximum	280 mm	11.02 in
Weight	44 kg	97 lb

Performance. Microturbo TRI 60/40 series engines have the following specific fuel consumption (SFC):

	<u>Metric Units</u>	<u>English Units</u>
TRI 60-2	1.26 kg/daN/hr	2.78 lb/hr/lbst
TRI 60-20	1.15 kg/daN/hr	2.54 lb/hr/lbst
TRI 60-30	1.10 kg/daN/hr	2.43 lb/hr/lbst
TRI 40	< 1.2 kg/daN/hr	< 2.65 lb/hr/lbst



TRI 60

Source: Microturbo

Variants/Upgrades

TRI 40. The 560- to 750-lbst (250- to 340-daN) TRI 40 is optimized for the new generation of anti-ship missiles, target drones, and remotely piloted vehicles. It can be started on the ground or by "windmilling" (i.e., turning by force of airflow).

The TRI 40's flight operating range is ground to 19,685 feet (6,000 m) at up to Mach 0.95. The engine runs on either JP8 or JP10 fuel.

TRI 60-1. The TRI 60-1 is the initial engine model in the TRI 60 series, rated at 786.87 lbst (3.5 kN) max continuous. It powers the BAE Sea Eagle (P.3T) anti-ship missile under the designation TRI 60-1 067. This engine variant is also assumed to power the Meteor SpA Mirach 300 and Mirach 600 air vehicles.

TRI 60-2 Series. The TRI 60-2 is a higher rated TRI 60-1, developing 832 lbst (3.7 kN) and providing power for the Aerospatiale C.22, Beech MQM-107B, and Saab RBS15 anti-ship missiles, prototypes of the Northrop NV-144/NV-151, and the Hindustan Aeronautics Ltd (HAL) pilotless target aircraft (PTA) reusable target drone (early models). The Model 097

was chosen to power production-model BQM-126s, the engine having the USN designation J403-MT-400.

TRI 60-3. The TRI 60-3 is an engine variant developing 900 lbst (4.0 kN). It powers the Beech BQM-126 target drone. This engine model has also been selected to provide power for MQM-107Bs for the U.S. Air Force.

TRI 60-5. The TRI 60-5 is an engine variant producing 990 lbst (4.4 kN). Mass flow is approximately 14.77 lb/sec (6.7 kg/s); compression ratio is 4.1:1. It was selected to power the Beech MQM-107B Streaker target drone, for which the power requirement was at least 950 lbst (4.44 kN).

TRI 60-20. The TRI 60-20 model is essentially a TRI 60 with an additional compressor stage. This engine's specifications and power output, as well as its applications, have yet to be made officially available. This designation may apply to engines for USAF needs.

TRI 60-30. The TRI 60-30 model is rated at approximately 1,200 lbst (5.33 kN). Mass flow is approximately 17.94 lb/sec (8.14 kg/s); compression

Microturbo TRI 40/TRI 60

ratio is 6.3:1. Its application is the Matra SCALP/APACHE and U.K. Storm Shadow.

TR 10. The TR 10 is to be an integrated propulsion system (IPS) that includes not only the turbojet itself,

but also the air inlet, exhaust, fuel pump, starting cartridge, and igniter. It is designed to power light missiles such as MBDA's Polyphème.

Program Review

Background. Plans for the Microturbo TRI 60 series of small turbojet engines called for high-volume production at optimum cost, and high thrust-to-weight ratio. It was the first Microturbo powerplant to employ an axial-flow compressor and an annular combustion chamber. It is ideally suited to such military applications as target drones, cruise missiles, anti-ship missiles, and remotely piloted vehicles, and has found success in penetrating those markets.

Bench testing of the first demonstrator engine began in 1974, at an initial thrust rating of 675 lbst. Additional funding has brought engine power up to the 786-lbst range in the TRI 60-1 and to the production-standard 990 lbst in the current TRI 60-5. Microturbo has a development and engineering program under way to increase the thrust to over 1,250 lbst.

Microturbo Inc. Microturbo Inc (Grand Prairie, Texas) is a licensee of Microturbo SA of France. The Texas-based firm is currently involved in the MQM-107D/E missile program in assembly, test, and shipment of engines.

While the shipment of engines for the MQM-107E is rapidly nearing an end, engines for the MQM-107D will continue to be manufactured in the near term, at modest production levels.

Microturbo Inc is also supplying TRI 60 engines to Saab for the RBS15M Mk 2 program.

Applications. Among the current or proposed applications of the Microturbo TRI 60 engine series are the following:

MISSILES

BAE Sea Eagle (P.3T). British Aerospace Dynamics announced in 1979 that the Ministry of Defence had awarded a contract to complete the development and evaluation of a second-generation all-weather, air-launched, sea-skimming, anti-ship guided missile. Since that decision, the Ministry of Defence has committed funding for the full development and initial production of the Sea Eagle (P.3T), also called the Cruise MARTEL.

Sea Eagle is a fire-and-forget anti-ship missile. It has a maximum speed of 610 knots (1,129 kmph) and a maximum range of 54 nautical miles (100 km). The active radar homing head and onboard computer, which

were developed by Marconi Avionics Ltd, enable the missile to be autonomous after launch. The TRI 60 engine gives it a considerable operational range and a stand-off attack capability. The aircraft applications for the Sea Eagle are RAF Buccaneers, Harriers, Sea Harriers, and Panavia Tornado IDSs. Engines are built by Microturbo Ltd in the U.K.

When production ended in 1992, an estimated 523 Sea Eagle systems had been built.

BAE Sea Eagle P.5T. In 1983, BAE announced that it was studying a ship-launched variant of Sea Eagle, designated P.5T. The P.5T is operationally similar to the P.3T, but it can be launched from Sea Dart missile mountings from ships down to 200 tons (181.5 metric tons). Additionally, BAE has made an unsolicited proposal to the Ministry of Defence to develop a cruise missile variant of Sea Eagle for an expected NATO specification. This missile would use the same TRI 60 powerplant as the standard Sea Eagle, but would incorporate a larger airframe and warhead with greater fuel capacity.

The first successful launch of the P.5T was made in 1987. The missile was in contention for a sizable contract for the new U.K. ship-launched anti-ship missile, but the U.K. chose the Harpoon system instead.

NSM. The Kongsberg/MBDA NSM anti-ship missile will be integrated onto naval platforms, coastal batteries, or helicopters, such as NH Industries' NH90. It weighs 165 pounds (347 kg). The missile is to meet the current demand of the Norwegian Royal Navy for a new generation of medium-range anti-ship missiles with a range of over 100 kilometers (62 stat mi).

Saab Bofors Dynamics RBS15. The RBS15 family of anti-ship missiles weigh 1,694 pounds (770 kg) and have a range in excess of 37.8 nautical miles (70 km). The RBS15M is a ship-mounted missile system used by the navies of Sweden and Finland, while the RBS15F is an air-launched system used by Sweden on its AJ 37 Viggen and JAS 39 Gripens. The first production models were delivered in 1983. A single TRI 60 powers the missile for the cruise portion of its flight path, assisted at launch by solid booster motors.

The RBS15 Mk 3 will be offered to the United Kingdom as a solution to its surface-to-surface guided weapon requirement. The Mk 3 will incorporate the

Microturbo TRI 40/TRI 60

uprated -30 version of the current Microturbo TRI 60-2 turbojet, providing a range that is believed to exceed 200 kilometers. The RBS15 missile program is undergoing a midlife upgrade of its weapon system, under the designation RBS15M Mk 2. The program, intended to extend the service life of the missile to the year 2015, includes modernization and performance enhancements, and will initially focus on the shipborne version. The program does not involve the inclusion of new-build engines, though the Mk 2+ program is expected to.

TSA. The Swedish Defense Materiel Administration has recommended that the Swedish government concentrate on the development of a new air-to-surface missile system called the Tungt Styrt Attackvapen (TSA), also known as the precision guided air-to-surface weapon or heavy guided attack weapon. This program is also referred to as the Autonomous Stand-Off Missile (ASOM). The weapon would be used by JAS 39 and JA 37 aircraft to attack land targets near coastal waters.

The Swedish government selected Saab Missiles as its prime contractor. If the weapon is powered, a TRI 60 variant would represent a logical engine choice for the system, being an RBS15-based design. Saab has been reluctant to release detailed information on its TSA project, although it is known that the weapon will have a warhead of several hundred kilograms and will be used to demolish large and heavily fortified targets. Bofors will be responsible for the warhead. The Swedish government has delayed the program as funding is channeled to support Gripen fielding. At the present time, the military has focused on development and eventual fielding of a ship/air-launched RBS15 Mk 3. Furthermore, there is still some doubt as to whether the TSA will be powered.

SCALP-EG (APACHE). France has developed a requirement for a new non-nuclear long-range general-purpose missile capable of defeating both non-hardened and hardened targets. The new requirement was originally known as Armement de Precision et à Très Grande Distance (APTGD) but its name was later changed to Système de Croisière Autonome à Longue Portée (SCALP). In December 1994, the APACHE was selected over the ASMP-C to fill the APTGD/SCALP requirement.

At first France was thought to be developing two different versions of the SCALP: the APACHE-AI and the APACHE-C. Budget cuts and the need to keep costs under control caused France to downgrade its performance requirements. Under the new designation, APACHE-EG (Emploi Général), France will develop a single system to meet its SCALP needs.

The SCALP-EG (formerly APACHE-EG) will have a range of around 250 kilometers. This range increase will be achieved through a reduction in the system's warhead weight, to 400-450 kilograms. The French government has ordered 500 SCALP-EGs.

Naval SCALP. MBDA is developing a naval version of its SCALP-EG known as SCALP Navale. The missile will provide the French Navy with a long-range land-attack capability for its surface combatants and submarines.

Reportedly, the French Navy plans to procure a minimum of 250 Naval SCALPs to meet its needs. This missile will arm the French Navy's new fleet of multimission frigates and the Barracuda-class nuclear attack submarines. According to media sources, the Italian Navy may be interested in procuring a navalized SCALP to arm its surface combatants.

Storm Shadow (CASOM). The CASOM (Conventionally Armed Stand-Off Missile) is an air-to-surface missile system sponsored by the U.K. Ministry of Defence for use in the destruction of fixed targets such as hardened bunkers, aircraft shelters, runways, and other stationary facilities. CASOM has taken over from the NATO Staff Group Target (Air) [ST(A)] 1236 requirement, which was frozen when the Modular Stand-Off Weapon (MSOW) system was canceled.

Numerous competitors offered their missile systems for the CASOM requirement, several of which featured solid-rocket-fuel motors. Matra proposed a version of its APACHE, called Storm Shadow, for the U.K. program. The Storm Shadow is equipped with a single high-explosive penetrating warhead and a datalink. The missile's range will be extended to 250 kilometers. Initial CASOM systems are now entering service with the U.K. Royal Air Force.

DRONES/TARGETS/RPVs/UAVs

EADS C.22/Palombe. The EADS (formerly Aerospatiale) C.22 is a variable-speed, radio-guided, recoverable subsonic RPV/target drone. Specifications include: maximum speed, Mach 0.95; maximum altitude, 45,932 feet (14,000 m); duration, 2.5 hours; and maximum payload, 220 pounds (100 kg). The 1,342-pound (610-kg) drone is ground- or ship-launched from ramp/rail-type launchers.

A further modernized C.22L, called Palombe, is being offered to the French Air Force to meet its next-generation aerial target requirement. Palombe has better low-speed maneuverability and a more accurate location and navigation capability, and it can be deployed more rapidly. The Palombe is to be 40 percent less costly than the current C.22L.

Microturbo TRI 40/TRI 60

The Palombe is also capable of serving as a platform for DROP (Drone Rapide Opérant dans la Profondeur, or "fast in-depth drone") missions. This version uses its 130-kilogram payload capacity to carry sophisticated imaging systems that perform penetration and reconnaissance missions in hostile territory. The DROP air vehicle would be released from a cargo aircraft at high altitude and have a range of 1,600 kilometers (range would be reduced to 600 km at low altitude).

The Palombe is competing to be selected as the next French Aerial Target; no selection date has been set. Production of the C.22L is expected to extend two years beyond any selection date.

Beech/U.S. Army MQM-107B. The MQM-107B is a subsonic missile target with a launch weight of 1,086 pounds (494 kg), a maximum speed of 530 knots (982 kmph), a maximum altitude of 40,000 feet (12,192 m), and endurance in excess of three hours. The U.S. Army has procured the Beech Aircraft Corp MQM-107B Streaker target drone. This modified MQM-107A was tested with both the TRI 60 and Teledyne Model 372, a 725-lbst (3.22-kN) variant of the J402 turbojet engine, with the designation MQM-107B given to the TRI 60-powered platform. An increased smoke tank capacity, improved waterproofing, and an enhanced autopilot for higher g maneuvering are standard in the B model. An estimated 244 MQM-107Bs were built, with engines provided by Microturbo Inc (formerly Microturbo North America); customers of the MQM-107B include the United States, Sweden, and Taiwan.

Composite Engineering Skeeter BQM-167A. Also known as the Air Force Subscale Aerial Target

(AFSAT), this drone was the result of a solicitation by the U.S. Air Force in late 2001 for a system that would replace the BQM-34 and MQM-107 targets. USAF was seeking a system with improved endurance – on the order of 60 minutes at 15,000 feet above sea level. Minimum speed would be 250 knots and maximum would be Mach 0.9. In follow-on variants, a 60,000-foot service ceiling would be required.

The USAF issued a Request for Proposals in February 2002, and later awarded a single demonstration contract to Composite Engineering of Sacramento, California, in the amount of \$6.6 million. The contract was expected to run 21 to 22 months, and required assembly of two preproduction Skeeters, as well as a flight demonstration and provision of a target test set, support services, and relevant data.

The Skeeter's configuration is similar to that of the MQM-107, and the vehicle is capable of air or ground launch. It is constructed mainly of carbon-fiber composites, and the single TRI 60 engine is ventrally mounted.

Indian PTA. Another potentially large-production candidate for the TRI 60 was the Hindustan Aeronautics Ltd (HAL) pilotless target aircraft (PTA), a 1,342-pound (610-kg) reusable target drone capable of speeds of Mach 0.4 to 0.85 and a range of 62.1 miles (100 km). While a few development and evaluation variants were powered by the Microturbo TRI 60, production versions are projected to be powered by the HAL PTAE-7 turbojet.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1974	First test of TRI 60 completed
	1977	C.22 development begins
Feb	1978	Engine selected for P.3T
Apr	1979	Contract let to Saab Bofors for RBS15
Jun	1980	First test of C.22 in France completed
	1982	Production go-ahead granted for Sea Eagle
Jun	1982	USAF testing of MQM-107B completed
Oct	1983	NU-144 rolled out
Mar	1984	First flight of NU-144
Sep	1984	U.S. Navy chooses TRI 60/Beech drone for BQM-126A program
Nov	1984	Microturbo awarded U.S. Navy contract for engines
Jun	1987	First flight of Matra APACHE
Early	1990	First TRI 60-5 engine shipped to USAF for trials
Jul	1990	Microturbo awarded U.S. Navy contract for TRI 60-5
Jan	1992	End of July 1990 contract timeframe
	2005	USAF Skeeter becomes available/NSM deliveries to begin
	2010	SCALP Navale variant production to begin
Thru	2016	Continued production/availability of Microturbo TRI 60 series

Worldwide Distribution/Inventories

While the production levels for several of the Microturbo TRI 60 applications are fewer than 25 units, other applications have reached sizable totals. Because many of the military applications are fire-and-forget-type air vehicles, exact inventory totals of platforms and engines are not attainable. Nations known to use TRI 40/60-powered platforms include the following: **Chile, China, Egypt, Finland, France, India, Iran, Italy, Jordan, Korea (ROK), Saudi Arabia, Sweden, United Arab Emirates, United Kingdom, and Yugoslavia.**

Forecast Rationale

Microturbo's TRI 60 engine series powers several major European missile programs and one target drone. MBDA's SCALP EG and SCALP NAVALE have won a stream of orders from European militaries, but defense spending has entered a downward cycle and the company is placing greater emphasis on export orders. The UAE is a possible customer for the SCALP EG, as is Saudi Arabia, Kuwait, and Taiwan. Greece may purchase a version of the naval SCALP for its FREMM frigates. MBDA reportedly has 2,200 SCALP-EGs on order, which could increase in the future with additional export contracts.

The Storm Shadow shares the TRI 60 engine, and saw its first combat deployment in Operation Iraqi Freedom. It is expected to remain in production until 2015.

Saab Bofors' RBS15 is an anti-ship missile in service with Sweden, Poland, and Germany. The company is hoping to win more orders from operators of the Saab

Gripen fighter, but this aircraft has had limited sales, so its missile production will remain dependent on Baltic Sea nations for continuing production.

France's Exocet anti-ship missile has been upgraded from its original solid fuel motor to the TRI 40 turbojet on the Block 3 variant, significantly extending its range. Sales in the Middle East are a large percentage of the program's business. The UAE, Greece, and Oman have purchased the Exocet and orders from other regional militaries are pending.

The sole target drone powered by the TRI 60 is the BQM-167A Skeeter. The U.S. Air Force is replacing its legacy Firebee and MQM-107s with the Skeeter, and the U.S. Army has also taken an interest in the drone.

Overall, we estimate TRI 40/60 production at 2,701 engines over the 10-year forecast period to support the aforementioned missile and drone programs.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Microturbo Inc												
TRI 60 Military <> BQM-167A	230	44	50	41	41	38	35	35	36	37	33	390
TRI 60 Military <> Storm Shadow	759	77	69	52	50	50	0	0	0	0	0	298
TRI 60 -30 Military <> RBS15 M MK 3	248	37	33	31	30	33	36	36	28	30	30	324
Subtotal	1,237	158	152	124	121	121	71	71	64	67	63	1012
Microturbo SA												
TRI 40 Military <> MM.40 Block 3	95	59	60	60	60	60	60	60	60	60	60	599
TRI 40 Military <> NSM	101	27	31	36	39	40	40	40	40	40	0	333

Microturbo TRI 40/TRI 60

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
TRI 60 -30 Military <> SCALP EG												
	419	58	58	58	58	58	51	50	0	0	0	391
TRI 60 -30 Military <> SCALP NAVALE												
	0	0	14	29	43	50	50	50	50	40	40	366
Subtotal	615	144	163	183	200	208	201	200	150	140	100	1,689
Total	1,852	302	315	307	321	329	272	271	214	207	163	2,701

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SHIPPING AND HANDLING RATES

	U.S.	World		U.S.	World		U.S.	World
Market Intelligence Services			Market Intelligence Libraries			Governments & Industries		
Binder	\$45	\$85	Complete Library			Binder	\$540	\$1,020
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Binder & DVD	\$95	\$180	Binder	\$1,575	\$2,975	International Military Markets		
Binder & RT	\$45	\$85	DVD	\$50	\$95	(A Subset of G&I above)		
Worldwide Inventories			Military Market Library			Binder	\$270	\$510
Aerospace Systems			Binder	\$1,440	\$2,720	DVD	\$50	\$95
CD	\$50	\$95	DVD	\$50	\$95	Naval		
Weapons Systems			Civil/Commercial Library			Binder	\$90	\$170
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Power Systems			Market Intelligence			Binder	\$90	\$170
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Hard Copy	\$25	\$45	DVD	\$50	\$95	DVD	\$50	\$95
			Electronics			<small>NOTE: No charge for Real-Time format.</small>		
			Binder	\$360	\$680	2011 Historic Art Calendar		
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