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COST *(In Millions)*	FY 1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	Cost To Complete	Total Cost
Total Program Element (PE) Cost	0.000	17.071	26.821	32.700	40.000	40.986	43.986	Continuing	Continuing
Advanced Aerospace Systems ASP-01	0.000	17.071	26.821	32.700	40.000	40.986	43.986	Continuing	Continuing

(U) Mission Description:

(U) The Advanced Aerospace Systems program element (PE) is budgeted in the Advanced Technology Development budget activity because it will address high payoff opportunities to dramatically reduce costs associated with advanced aeronautical and space systems or provide revolutionary new system capabilities for satisfying current and projected military mission requirements. Research and development of integrated system concepts, as well as enabling vehicle subsystems will be conducted. This new PE was created to satisfy an Agency requirement for a dedicated host for aerospace research that has progressed beyond the applied research stage and no longer belongs in the 6.2 based Tactical Technology program element (PE 0602702E). Two of the three initial programs in FY 2000 are outgrowths from this PE.

(U) The Supersonic Miniature Air-Launched Interceptor (MALI) program will demonstrate an inexpensive supersonic air platform with a low cost uncooled infrared (IR) sensor to provide cruise missile defense by exploiting large rear aspect IR signatures and overtaking incoming missiles from the rear. As a further cost reduction, the program will leverage off the existing miniature air-launched decoy (MALD) program's technology and off board surveillance and tracking sensors to provide tail-on missile end game opportunities (MALD was funded in FY 1999 from Project TT-06, PE 0602702E). An advanced unmanned air vehicle avionics development and emerging payload effort will be incorporated into the MALI core program due to the required data transmit/receive survivability configuration of the interceptor mission.

(U) The Navy and the Marine Corps have a need for affordable, survivable, vertical take-off and landing (VTOL) unmanned air vehicles (UAV) to support dispersed units in littoral and urban areas. DARPA, in partnership with the Office of Naval Research (ONR) and industry, have formulated the Advanced Air Vehicle (AAV) program to explore two innovative vertical take-off and landing (VTOL) concepts with the potential for significant performance improvements that would satisfy stressing mission needs. The first, an advanced Canard Rotor/Wing (CRW) aircraft, offers the potential for a high speed (350 knots), rapid response capability from a VTOL unmanned air vehicle (UAV) with significant range (500 nm) and stealth improvements as compared to other VTOL concepts. Detailed design, fabrication and flight test of this scaled vehicle concept will

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be conducted to validate the command and control, stability and control system and aerodynamic performance required for vertical take-off, landing (VTOL) and hover via a rotating center wing which is stopped and locked in place for efficient high speed cruise. The second concept (A160), will exploit a hingeless, rigid, rotor concept to produce a VTOL unmanned air vehicle (UAV) with very low disk loading and rotor tip speeds resulting in an efficient low power loiter and high endurance system. This unique concept offers the potential for significant increases in VTOL UAV range (>2000nm) and endurance (>24-48 hours). Detailed design, fabrication and testing of this concept will be conducted to establish its reliability, maintainability and performance.

(U) The Orbital Express Space Operations Architecture program will develop and demonstrate robotic techniques for on-orbit preplanned electronics upgrade, refueling and reconfiguration of satellites that could support a broad range of future U.S. national security and commercial space programs. An important element of the program is the enabling nature of such capability for new space missions and its potential to reduce space program costs through spacecraft life extension (“Pre Planned Product Improvement,” or “P3I”), comparable to what is done today with aircraft. During Phase I (Concept Definition) the type of satellite servicing to be emulated in the on-orbit demonstration will be identified (to include the type of hardware upgrades and reconfiguration to be supported, and the techniques to be adopted in transferring hardware and fuel between spacecraft), and detailed designs will be developed for “industry standard,” nonproprietary satellite-to-satellite mechanical and electrical interfaces enabling on-orbit hardware and fluid transfers. In Phase II, preliminary system design will emerge in conjunction with developments in software and sensors necessary for robotic space operations; and the technical feasibility and affordability of using water, or other new or innovative fuel or fuel stock, will be assessed as a potentially significant cost savings for space operations. In Phase III, detailed design of the on-orbit demonstration spacecraft (the service vehicle, the demonstration “target,” or serviced satellite, and the depot for replacement hardware and fuel) will occur; and the spacecraft will be fabricated, integrated, ground tested, and space-qualified. Finally, in FY 2004, the demonstration spacecraft will be launched. On-orbit, the Orbital Express spacecraft will repeatedly demonstrate the feasibility of roboticly upgrading, refueling and reconfiguring satellites. (The FY 2001 funding of this program’s technology development is exploiting the development of advanced tactical technology concepts and compact laser technologies (approximately $5 million) funded under PE 0602702E, Project TT-06 in FY 2000 as well as other efforts in this Project, ASP-01.)

(U) <u>Program Accomplishments and Plans:</u>

(U) <u>FY 1999 Accomplishments:</u>

- Not Applicable.

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(U) **FY 2000 Plans:**

- Advanced Air Vehicle (AAV). ($ 9.453 Million) [Future Combat Systems – related = $5.000 Million]
  - Continue fabrication and conduct hardware in the loop and ground testing of Canard Rotor/Wing (CRW) and A160 concepts.
  - Complete fabrication of two A160 prototypes and conduct ground and flight tests.

- Supersonic Miniature Air-Launched Interceptor (MALI). ($ 4.336 Million)
  - Conduct engine and low cost miniature sensor and advanced payload testing.
  - Fabricate, assemble and conduct ground and early risk reduction testing of air vehicle.
  - Develop airborne inter-vehicle communications, mission processing and execution.
  - Initiate detail test planning for flight demonstration of interceptor and collaborative formation mission.
  - Explore other concepts for low cost MALI/MALD airframes to fill mission areas such as reconnaissance, surveillance, nuclear/biological/chemical (NBC) detection, jamming, etc.

- Orbital Express Space Operations Architecture. ($ 3.282 Million)
  - Conduct mission utility, cost and cost effectiveness trade studies and analyses. Develop preliminary on-orbit demonstration test plan and program risk assessment and mitigation plan. Identify key enabling technologies, and develop a technology development plan.
  - Select industry proposed baseline mission and satellite-to-satellite interface concepts.
  - Conduct a system requirements review.
  - Develop competing detailed interface designs.

(U) **FY 2001 Plans:**

- Advanced Air Vehicle (AAV). ($ 2.978 Million)
  - Complete Canard Rotor/Wing (CRW) fabrication and conduct ground and flight tests.
  - Continue flight tests of A160 air vehicle.
  - Design sensor integration modifications to A160 air vehicle.

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- Supersonic Miniature Air-Launched Interceptor (MALI). ($ 6.958 Million)
  - Continue air vehicle fabrication, assembly and conduct ground testing.
  - Demonstrate airborne inter-vehicle communications, mission processing and execution.
  - Perform supersonic engine flight verification and seeker/advanced payload verification.
  - Conduct flight demonstration of supersonic vehicle interceptor and collaborative formation flying mission.
  - Continue to explore other concepts for low cost MALI/MALD airframes to fill mission areas such as reconnaissance, surveillance, nuclear/biological/chemical (NBC) detection, jamming, etc.

- Orbital Express Space Operations Architecture. ($ 16.885 Million)
  - Select detailed design for standard (non-proprietary) satellite-to-satellite electrical and mechanical interfaces.
  - Develop competing preliminary system designs.
  - Complete on-orbit demonstration test plan, program risk assessment and mitigation plan, and technology development plan.
  - Conduct a second system requirement review and preliminary design review.
  - Select demonstration system preliminary design.
  - Begin detailed final system design.
  - Initiate development of key enabling technologies/subsystems.

(U) Program Change Summary (*In Millions*)

	FY1999	FY 2000	FY 2001
Previous President's Budget	0.000	19.664	19.000
Current Budget	0.000	17.071	26.821

(U) Change Summary Explanation:

FY 2000 Decrease reflects congressional reduction for MALI and the government-wide rescission.

FY 2001 Increase reflects expansion of the Orbital Express Space Operations Architecture effort and completion of flight tests of A160 air vehicle.

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(U) Other Program Funding Summary Cost:

- Not Applicable.

(U) Schedule Profile:

Plan	Milestones
Apr 00	Advanced Air Vehicle (AAV): Flight test A160 air vehicle.
May 00	AAV: CRW Detailed Design Review.
Jun 00	MALI: Perform engine critical design review.
Aug 00	AAV: Complete A160 flight control system testbed flights.
Aug 00	MALI: Perform Critical Design Review (CDR) after conducting performance trades.
Sep 00	Orbital Express Space Operations Architecture (OESOA): Complete concept definition and mission utility analysis. Select baseline mission and satellite-to-satellite interface concepts.
Sep 00	AAV: Complete CRW ground testing.
Sep 00	MALI: Perform seeker captive carry flight-testing.
Nov 00	OESOA: Complete on-orbit demonstration test plan, and program risk assessment and mitigation plan.
Dec 00	MALI: Complete vehicle recovery system demo.
Jan 01	MALI: Complete engine altitude chamber testing.
Jan 01	Orbital Express Space Operations Architecture (OESOA): Conduct system requirement review.
Mar 01	Miniature Air-Launched Interceptor (MALI): Deliver first supersonic engine.
Mar 01	MALI: Complete avionics environment verification testing.
May 01	MALI: Conduct subsonic flight readiness review/supersonic CDR.
Jun 01	MALI: Perform formation flight demo.
Jun 01	OESOA: Preliminary Design Review.
Aug 01	MALI: Perform intercept flight demonstration.
Aug 01	Advanced Air Vehicles: Complete flight tests of both Canard Rotor/Wing and A160 vehicles.
Oct 01	MALI: Complete installed engine testing.
Oct 01	MALI: Conduct flight readiness review.

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Jan 02	OESOA: Critical Design Review.
Jan 02	MALI: Perform supersonic flight demonstration.