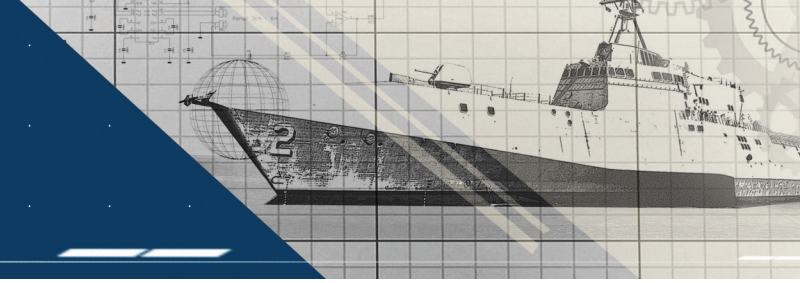
OFFICE OF NAVAL RESEARCH

FNC GUIDEBOOK

Table of Contents

Executive Summary



Initiated by the Department of the Navy in 2002, the Future Naval Capabilities (FNC) program is a science and technology (S&T) program designed to develop and transition cutting-edge technology products to acquisition managers within a three- to five-year timeframe. The program aims to deliver mature products for integration into platforms, weapons, sensors or specifications that improve Navy and Marine Corps warfighting and support capabilities.

The requirements-driven program is governed by a set of formal business rules, which ensure all stakeholders are involved in the program's oversight, management and execution. By design, the program strengthens S&T coordination between the fleet/force, S&T, acquisition and resources/requirements communities.

Technology products usually begin at a point where analytical and experimental proof-of-concept or component/breadboard validation has been established in the laboratory. The products subsequently are matured during the course of the three- to five-year product development cycle such that a model or prototype can be demonstrated in a relevant environment.

Once the technology is demonstrated, the acquisition sponsor takes responsibility for conducting any additional research, development, test and evaluation (RDT&E) necessary to engineer and integrate the product into an acquisition program of record, or other program, that will ultimately deploy the new technological capability into the fleet or force.

Development and Oversight

FNC products fall into nine functional areas of development, called pillars. Each pillar is managed by a two-star-level integrated product team (IPT) and their IPT working groups, which are composed of representatives from the S&T, acquisition and resource/requirements communities as well as the fleet and force. IPTs are charged with developing S&T capability gaps, or detailed requirements, that address technology needs in their respective areas.

S&T capability gaps are reviewed and approved by a Technology Oversight Group (TOG), a three-star-level IPT tasked with FNC program oversight by the vice chief of naval operations, assistant commandant of the Marine Corps and assistant secretary of the Navy for Research, Development and Acquisition (ASN)(RDA).

FNC Pillars:

- **Capable Manpower:** Intuitive systems and personnel tools for matching Sailors and Marines to the right jobs and training for mission-essential competencies
- **Enterprise and Platform Enablers:** Cross-cutting technologies to lower acquisition, operations and maintenance costs
- **Expeditionary Maneuver Warfare:** Naval ground forces with special emphasis on regular and irregular warfare
- **Force Health Protection:** Medical equipment, supplies and procedures to reduce morbidity and mortality when casualties occur
- **FORCEnet:** C4ISR; networking; navigation; decision support; and space technologies that provide an architectural framework for naval warfare in the information age
- **Power & Energy:** Energy security, efficient power and energy systems, high energy, pulse power
- **Sea Basing:** Logistics, shipping and at-sea transfer technologies that provide operational independence
- **Sea Shield:** Missile defense, antisubmarine warfare, mine warfare and fleet/force protection technologies that provide global defensive assurance
- **Sea Strike:** Weapons, aircraft and expeditionary warfare technologies that provide precise and persistent offensive power

CO-CHAIRS: N8/Marine Corps Combat Development Command
PERMANENT MEMBERS: Principal Military Deputy (ASN) (RDA), Deputy Commander, U.S. Fleet Forces, CNR, N2/N6, N9
EQUITY MEMBERS: N1, N4, N093, deputy chiefs of naval operations and deputy commandants

Figure 1 – Technology Oversight Group

As depicted in Figure 1, the TOG is co-chaired by the deputy chiefs of naval operations (DCNO) for Integration of Capabilities and Resources (N8), and the commanding general of the Marine Corps Combat Development Command. Permanent TOG members also include the deputy commander of U.S. Fleet Forces Command; the principal military deputy to ASN-RDA; the DCNOs for Information Dominance (N2/N6) and Warfare Systems (N9); and the chief of naval research (CNR). Additionally, DCNOs and deputy commandants outside the purview of TOG member organizations may participate on issues that address their equities.

ONR: The S&T Developer

The Office of Naval Research (ONR), through the Office of Transition (ONR 03T), responds to S&T capability gaps by proposing technology investments called "enabling capabilities" (ECs). An EC typically consists of one or more interrelated products, which together provide a distinct capability to address one or more gaps. EC investments are subjected to an extensive vetting process within ONR, and subsequently by the IPTs, before reaching the TOG.

The TOG weighs the priorities of all IPTs before establishing a comprehensive, balanced ranking of proposed ECs. While the intent is to support as many ECs as possible, only 40 percent typically can be funded in any given year due to resource limitations.

Once an EC and its associated technology products begin execution, a series of ongoing reviews ensure continuing collaboration among the S&T, acquisition and resource communities:

- Bimonthly: ONR 03T reviews cost, schedule and technical progress, as well as transition status.
- Annual: IPTs formally assess each product's transition status.

Additionally, all products must have signed technology transition agreements (TTAs) in place. These negotiated agreements document the commitment of the resource sponsor, acquisition program manager and S&T manager to complete a product's development and to pursue its integration into the acquisition program targeted to carry the new capability forward to the fleet/force.

TTAs are vital to the FNC Program's success. IPTs coordinate with the stakeholders to designate the specific resource sponsor and acquisition program manager signatories that are authorized to sign each product's agreement.

As products continue in S&T development, TTAs must contain increased specificity and commitment levels. Updated annually, TTAs demonstrate continued stakeholder consensus that the product's development status and transition path remain viable.

Products may be terminated for any one of the following reasons:

- Cost, schedule or technical objectives become unachievable.
- A viable transition path is no longer present.
- The required TTA commitment level cannot be attained.

Any funding recovered or saved as a result of product development termination is reapplied to address issues with existing products or to start new ECs in accordance with the TOG's established priorities.

Track Record of Success

Since 2002, the FNC program has completed S&T development of approximately 85 percent of the products initiated. Of those completed, roughly 50 percent either have been deployed or currently are tracking for future deployment to the fleet/force.

The FNC program is structured to accommodate both the dynamic nature of Navy and Marine Corps requirements and the rapid pace of technology development. The annual S&T capability gap process and the annual selection of new ECs create a continually updated and relevant technology portfolio. This enables the program to respond to changing requirements with novel and innovative solutions.

FNC Management: Structure, Roles and Responsibilities

Structure

Both the TOG and the IPTs operate as consensus bodies under the leadership of the TOG co-chairs. As the resources and requirements voting representatives, the co-chairs are responsible for representing the interests of all Navy/Marine Corps requirements offices that have a role in transitioning FNC products. Similarly, the TOG's acquisition, S&T and fleet/force voting members represent the collective interests of their respective communities.

As with any large program composed of multiple products and stakeholders, the IPT and TOG senior managers rely on working group representatives, who are responsible for the day-to-day management of their organizations' responsibilities. The TOG executive secretary works closely with the IPT principals and the TOG, while the TOG working group members deal extensively with IPT working group members.

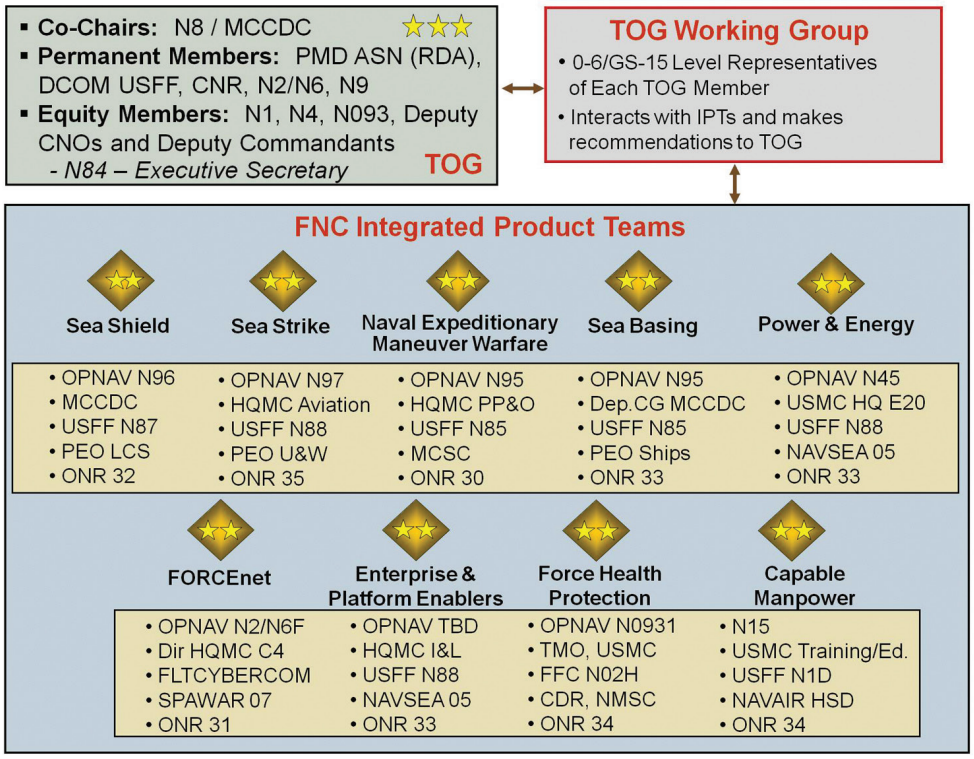


Figure 2 – FNC Management Hierarchy

Each EC is assigned to one of the nine pillars based on its alignment to the S&T capability gaps managed by that IPT. Since pillars may have more than one EC approved to start in a specific fiscal year, a sequential designator is assigned to distinguish ECs within a fiscal year. For example, SHD-FY10-01 indicates a Sea Shield EC that was approved to start in fiscal year 2010, with the sequential designator of 01.

IPTs, which can manage as many as 20-30 products, must maintain effective communications with the resource sponsors, acquisition program managers and S&T managers responsible for each product to execute their chartered responsibilities. IPTs ensure that ECs properly address the S&T gaps and provide a meaningful and affordable improvement of military utility. They annually review all products within each EC and make recommendations to continue, adjust or terminate products. They also provide an annual transition report to the TOG, via the chief of naval research. This report details the status of transition planning for each product and identifies challenges to products' successful transition, as outlined in their signed TTAs.

Team Players

ONR functions as the S&T program execution manager responsible for developing and delivering all ECs and products. ONR EC managers oversee and manage the product managers, who are responsible for the performance, schedule and execution of each product—including deliverables, metrics and exit criteria. ONR Senior Executive Service-level managers serve as the senior S&T representatives on each IPT.

The acquisition community, consisting of the program executive offices, direct-reporting program managers and system commands are responsible for integrating and fielding successfully completed products into operational systems scheduled for delivery to the fleet/force.

The resource sponsors are responsible for planning and programming the funds required for successfully integrating and delivering products into their targeted acquisition programs of record.

Fleet/force personnel, the ultimate end users of the capabilities delivered, engage throughout the process to identify, define and prioritize requirements. They ensure planned product transitions are suited to warfighting needs.

New Investments–The EC Development and Selection Process

ECs are selected annually by an established process that involves all of the FNC stakeholders. The process begins when the IPTs, representing the nine FNC pillar focus areas (e.g., Sea Shield, Sea Strike, Sea Basing, etc.), initiate development of an annual set of S&T capability gaps.

Beginning in January, the IPTs coordinate closely with Navy and Marine Corps headquarters—as well as the fleet—to identify S&T capability gaps that cannot be closed with the current state of platforms, weapons systems, science, technology, doctrines, organizational structure, training, materials, leadership, personnel and facilities. Closure of these gaps is only possible with an additional S&T investment. IPTs define gap requirements but do not specify the technology approach necessary to address the need.

Gap requirements can define a very specific lack of capability or an important area of focus that senior naval leadership has identified as a priority. Each year, the prior year's gaps form the baseline on which the IPTs base their work. A variety of studies, analyses and other inputs are considered in the gap analysis.

Metrics developed for each gap provide additional detail and specificity, which help to further focus technology development efforts as well as determine the extent to which proposed ECs and products address naval needs.

Roundtables and EC Proposal Generation

Early in the calendar year, IPTs conduct roundtable meetings for all stakeholders with a role in the gap development process. These meetings are critical to the process as they allow the IPTs to present draft requirements and solicit feedback. The meetings provide an opportunity to ask questions and render feedback. The roundtables enable a clearer understanding of the gaps, provide a forum to ensure the gaps accurately represent fleet/force requirements and serve to solidify a mutual understanding among all FNC stakeholders.

Each IPT revises and finalizes their gaps based on insights gained from the roundtables. The executive secretary for the TOG requires each team to identify its top three (non-prioritized) gaps. The TOG selects and releases to ONR the final gaps in June, if not earlier.

At ONR, each of the gaps is assigned to a lead technical department, which is responsible for assessing candidate gap-closing solutions. While development of new EC proposals starts early in the calendar year, it picks up momentum after the gaps are formally released.

The goal of each EC is to close or significantly address one or more gaps within a three- to five-year period. ONR and the IPTs work closely to ensure that EC proposals properly address one or more gaps and that the interrelated products within those ECs have stakeholder support for transition.

An EC proposal clearly describes the capability it will deliver and the metrics that will be used to measure its success. Individual products within an EC have more detailed metrics, called exit criteria, which are negotiated as part of the TTA and become the key criteria for measuring the success or failure of the S&T development for those products. Exit criteria define the specific product's contribution to the closure of the relevant gaps. Each EC proposal contains specific cost and schedule information as well as detail about other S&T efforts where leverage or collaboration is planned as part of the S&T development effort.

ONR leadership requires at least one potential EC proposal, or topic, be considered for every gap. Each ONR technical department implements a schedule for developing and screening topics to ensure that every gap is addressed. The breadth of ONR's basic research program is an important factor that enables topics responsive to all of the gaps to be considered. These topics are discussed with the appropriate IPT stakeholders. A mapping of topics considered for each of the gaps is reported to the CNR.

Internal ONR EC Proposal Reviews

Consulting heavily with the stakeholders, ONR's technical departments review and select a subset of the topics considered to go forward as fully developed EC proposals. Each department is authorized to submit up to a set number of proposed ECs. Proposals are uploaded to a collaborative workspace for assessment by technical experts and subject-matter experts. Comments, questions and recommendations are encouraged so that ONR advocates can address noted issues when the proposals are formally presented to a technical review board.

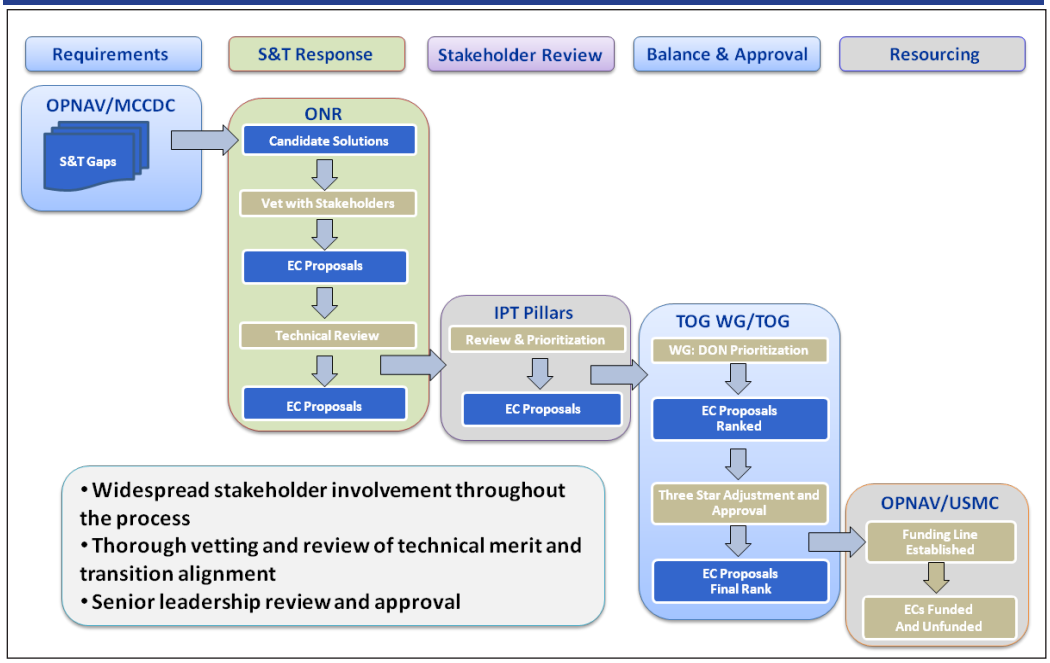
In the October/November timeframe, ONR leadership convenes a technical review board to assess the proposed ECs. This board consists of the senior technical leadership at ONR, including all department heads and portfolio directors. This board approves ECs, which are then released from ONR to the TOG working group for distribution to the applicable IPTs.

If an EC is not technologically ready or its proposed S&T content is not considered appropriate for the FNC program, it is not released for further assessment.

Technical review panel members consider the following issues, among others:

- Does the proposed EC deliver a distinct, quantifiable capability that contributes to closing an identified S&T capability gap?
- Does the proposed EC need to start per its schedule?
- Do the technical metrics adequately quantify and define the capability the proposed EC will deliver?
- Does the technical approach for each individual product in the EC have merit?
- Are the individual product budgets appropriately justified?
- Do the individual products have appropriate S&T content?
- Do the individual products have a manageable degree of technical risk that could be abated during the three- to five-year product development timeframe?
- Is the transition path of the proposed EC reasonably aligned to acquisition program milestones?
- Are the target acquisition and resource sponsors identified?

Figure 3 – FNC New Start Process



Prioritization of EC Proposals

All EC proposals that make it through ONR's internal technical review board are further assessed and prioritized by the appropriate IPTs. The IPTs evaluate and prioritize the proposals based on a range of criteria, including:

- Alignment with prioritized warfighting and supporting needs
- The impact of the EC on closing its S&T capability gap(s)
- Military utility versus cost
- Support for transition

IPTs review all products within the proposed ECs and may make recommendations to delay or drop products when appropriate. Each IPT forwards a single prioritized list of proposed ECs and any recommended changes to associated products to the TOG working group.

Review of Proposals and Approvals of 'New Starts'

In December/January, approximately six to seven months after the TOG's approval of the annual S&T capability gaps, the TOG working group receives briefs on each proposed EC. The group carefully considers each IPT's recommendations and consolidates the IPT prioritized lists into a single prioritized list of candidate ECs that offer optimum balance to the Navy and Marine Corps. In February/March, this list is formally presented to the senior TOG members for final review and approval. The TOG strives to achieve a balanced naval S&T portfolio, while considering each IPT's priorities in its respective functional area. [Note: ECs within the Capable Manpower pillar are prioritized separately, as OPNAV N1 resources the S&T funding for this pillar and establishes its own priorities.]

ONR funds new ECs in strict compliance with the TOG-approved EC priorities list consistent with Navy and Marine Corps programmed and budgeted FNC resources. Typically, only about 40 percent of the proposed ECs can be funded in any given year due to resource limitations.

The FNC budget is routinely subjected to naval and/or congressional budget cuts. In such cases, ECs and products may be delayed or terminated until funding can be properly realigned. In most cases, unless there is a prejudicial cut, these actions follow the TOG's list of EC priorities. The TOG must approve any deviations to its established priorities when dealing with budget related issues. The FNC new start process for technology refresh is depicted in Figure 3.

Ongoing ECs – Budget, Execution Management and Transition Oversight

The FNC program is resourced by a complementary set of budget activity (BA) 2 and 3 RDT&E lines in both the Navy and Marine Corps. Due to the nature of FNC investments, ECs/products are constantly ending and new ones are starting. The budget for the FNC program has been carefully constructed to include, within the overall program controls, an annual technology refresh process. Each year, the FNC program is able to allocate approximately $450 million over the future years defense program to new investments. This structure provides stability for approved investments while simultaneously supporting technology refresh for new investments. This annual process ensures the FNC program is constantly being updated to respond to the highest priority S&T capability gaps of the Navy and Marine Corps.

Another significant factor that promotes stability in the financial structure of the FNC program lies within the FNC business rules, which are periodically updated and issued by the TOG. These business rules require Program Objectives Memorandum year funding adjustments to be absorbed within the programmed refresh amounts by simply moving the funding cut line of proposed "new start" ECs on the TOG priorities list until the investments can be covered by the available funds.

Execution Management

While the annual cycle for refreshing the FNC program with new EC investments is ongoing, other processes that govern the management of previously approved products are also underway.

As the execution agent, ONR has implemented an organizational structure that provides for a centrally managed, monitored and controlled FNC program. The key to making the process work lies in the leverage that is obtained by controlling the S&T funding. Under ONR's 03T, FNC business planning guidance is issued each year, requiring EC/product managers to submit annual baseline business plans and updated TTAs for every product that has budgeted funds. Compliance with this guidance, as well as assurances from the IPT that transition planning is on-track, is required before the director of transition releases funds to the execution managers for the upcoming FY.

Once the execution year begins, ONR's 03T schedules pillar-specific bimonthly status meetings with the ONR S&T managers developing technology within each pillar. These meetings are set up to review S&T accomplishments and upcoming events, and to discuss transition issues. Also on a bimonthly basis, the executing departments are required to submit technical progress reports. These reports address S&T development issues for each performer participating in the development of a product. They are used to identify S&T execution issues early, so that corrective actions can be taken. ONR informs the IPTs and the TOG of any significant problems that could impact its ability to deliver products in accordance with their TTAs.

Technology Transition Agreements (TTAs)

The TTA is the fundamental document used to manage product transition. The TTA is a negotiated and signed document that articulates the commitment of each stakeholder to develop, transition and deploy a product to the fleet/force. It is a good-faith agreement of intent between the stakeholders; its management and negotiation is critical to the FNC process.

TTAs are not legally binding contracts; they serve to document signatory intent. Each agreement requires that stakeholders, among other things, clearly describe the product being developed; specify the threshold and objective performance attributes the product must meet (e.g., exit criteria); describe the integration strategy that will be used to bring the product into an acquisition program of record; and estimate and eventually program the acquisition funding required to execute the integration strategy. Lessons learned have demonstrated that negotiating annual updates to TTAs eliminates uncertainty and thus increases the likelihood of successful S&T transition and deployment. There are three levels of TTAs, each of which is required at specific timeframes during the S&T development period. Each level requires more detail and an increased commitment from the stakeholders as the product matures. There are specific templates documenting the requirements for each level.

- Level C – The initial TTA, required before the first year of S&T funding is released
- Level B – The working-level TTA
- Level A – The final and committed TTA, required before the final year of S&T funding is released

In addition to specifying the required content for each level, the TTA template contains required signature statements that detail stakeholder commitments. These statements, which have been approved by the TOG, cannot be altered, or the TTA will not be accepted. They commit the signatories to specific actions. For example, the resource sponsor must state its intention to either fund the necessary transition by a specific timeframe (Levels C and B) or indicate that transition funding is programmed (Level A). The acquisition sponsor provides transition

Figure 4 – Transition Commitment Level (TCL)					
Strength of Transition Commitment / Years of S&T Development Remaining	1	2	3	4	5+
TTA Level A-Committed	A1	A2	A3	A4	A5
TTA Level B-Working	B1	B2	B3	B4	B5
TTA Level C-Initial	C1	C2	C3	C4	C5

funding estimates for Level B agreements, which are refined annually until the final Level A agreement is signed, providing the best estimate before transition.

The IPTs trigger the start of the annual TTA cycle by informing the TOG executive secretary (OPNAV N84) of the proper TTA resource sponsor and acquisition manager signatories for each product scheduled for execution during the upcoming fiscal year. This occurs no later than April 1. One month later, ONR EC managers are required to submit draft TTAs to their transition partners. This allows two months for negotiations between the signatory organizations before the signed TTAs are due. Many managers begin this process well in advance of the deadline.

Signed TTAs are due to the FNC staff at ONR no later than July 1, where they are assessed for compliance with the appropriate TTA level template and assigned a transition commitment level (TCL).

Transition Commitment Levels (TCLs)

The TCL is a color-coded alphanumeric designation, directed by the TOG, which reflects both the TTA level and the number of years of S&T development remaining. It functions as a forward-looking planning tool. With the start of each new TTA cycle, products are assigned the TCL that will be in effect as of the first day of the upcoming fiscal year (Oct. 1).

As shown in Figure 4 above, TCLs are assigned using a TOG-approved matrix in which the colors indicate a particular status:

a. Green signifies the TTA is at the required level.

b. Yellow indicates the TTA is at an acceptable level, though an upgrade is recommended.

c. Red indicates the TTA is not at an acceptable level, and an upgrade to the next level is required or the product will be considered for termination.

The TCLs and their colors inform the stakeholders when an upgrade to the next TTA level is required. For example, a green C5 TCL signifies that a product has achieved a Level C agreement with five years of remaining S&T funding. It would not be mandated to have a TTA level upgrade for two years; however, it would be recommended to have an upgrade after one year.

If a TTA does not attain the required level and the TCL is red, ONR's FNC staff works with the TTA stakeholders to address the deficiencies identified. Failure to achieve the required TCL has potentially serious consequences. At a minimum, a product that does not achieve the required TCL by the July 1 TTA deadline is placed on a potential termination list. TCL issues for products placed on the potential termination list are escalated up through the IPTs to see if two-star level attention can help resolve the issues. The IPTs then make a recommendation to the TOG, which will determine if the product should be terminated or continued. Products with transition issues are rarely continued unless the TOG deems a compelling reason to finish it.

Regardless of whether an upgraded TTA is required to achieve the required TCL for the upcoming fiscal year, agreements must still be signed or validated every year. This requirement stems from a lesson learned that early and continuous engagement of the stakeholders is essential to ensuring successful technology product transitions. The TTA is the fundamental document that allows each stakeholder to refine and confirm its commitment to develop, transition and ultimately deploy the FNC program's products into the fleet/force.

IPT Transition Assessments

Each summer, the IPTs conduct an assessment of each product in execution to validate its overall transition status. The outcome of this assessment is the IPT Transition Assessment Report, which is intended to ensure that:

- The transition strategy is current and valid.
- Transition planning is on track per the TTA.
- Transition funding is appropriately aligned to ensure successful S&T integration and eventual deployment to the fleet/force.

IPTs, which consider S&T development status, the TCL and any known or emerging changes to targeted acquisition programs of record, make an annual recommendation of whether to continue S&T development into the following fiscal year. As in the case of the TCL, if an IPT rates the transition status of a product as failing, this annual assessment can place that product on a potential termination list. The results of the IPT transition assessments are delivered to the CNR, who assesses all noted transition issues and presents the findings to the TOG. Only the TOG can continue a product with a red TCL or IPT transition rating.

TOG Meetings

In addition to approving the S&T capability gaps, the TOG assesses, integrates and balances FNC investments across the IPT-managed capability areas. The TOG meets biannually:

- At its fall meeting, it reviews the results of the annual IPT transition assessment and TTA update processes. It receives an FNC budget update from the CNR, makes a final decision on unresolved transition and TCL issues and approves adjustments to the FNC program based on terminated products and other S&T development issues.
- At its spring meeting, the TOG again receives an FNC budget update from the CNR, reviews the recommended EC new-start priorities list, adjusts the list as required and approves a final set of ECs priorities for the upcoming program objectives memorandum year.

The TOG resolves all major FNC program issues and approves any changes to the program as required, providing top-level direction to facilitate the transition of products to acquisition programs.

Process Improvement

A variety of methods are employed to continually evolve and improve the FNC program's processes. Reviews are conducted after all major events to identify areas for improvement; off-site meetings are conducted to gather feedback on potential process changes; various external and internal workshops are conducted; and each FNC training session includes feedback forms. As an example, three transition-focused workshops were convened to analyze transition successes and failures and to identify best practices and lessons learned; all stakeholders were represented. The goal of these workshops was to strengthen and improve transition success rates. The results were briefed to the TOG, along with recommended program changes, which were subsequently adopted.

Consistent with a continuous process improvement approach, ONR frequently conducts internal off-sites led by its 03T. These meetings are conducted between the FNC staff and ONR technical department representatives to review and discuss a variety of FNC topics and ONR-managed FNC processes. Recent off-sites have led to internal process changes at ONR for execution oversight and annual FNC business planning requirements. Actions taken as a result of these internal off-sites have reduced administrative overhead and time demands on ONR's EC and product managers.

Completed ECs

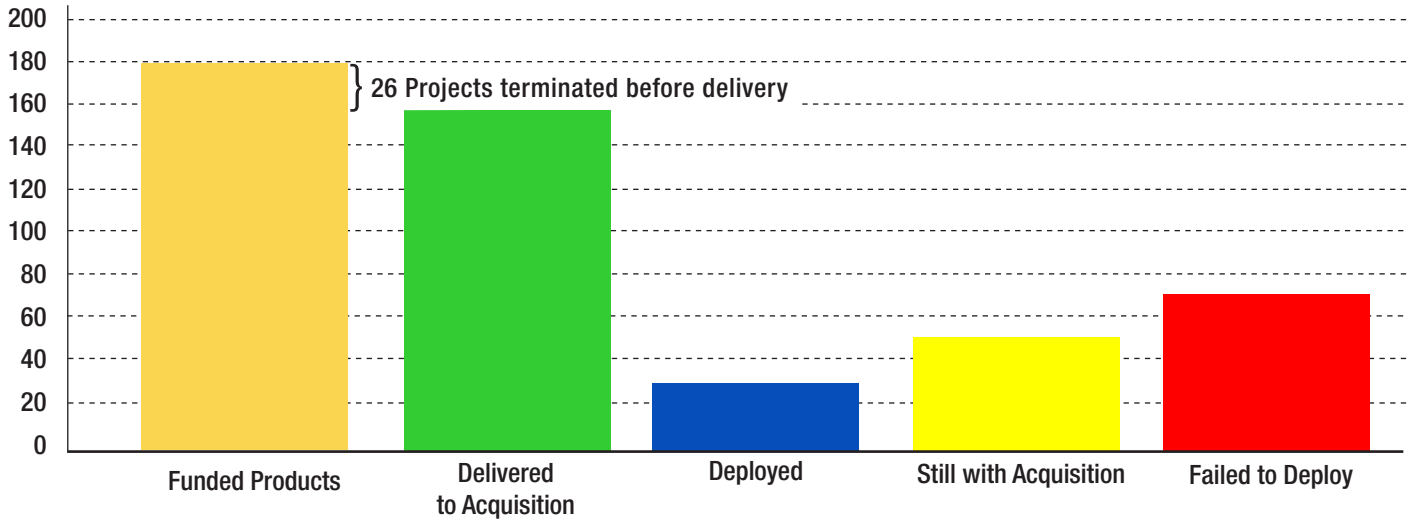


Figure 5 – Transition Review Board Results Through 2011

Transition Review Board

The concepts of transition and deployment are important to the FNC process. Transition involves a shift in development and funding responsibility from the S&T developer (ONR) to the acquisition program manager. Deployment involves the acquisition manager's delivery of a fully supported FNC capability into the fleet/force. Agreement on the meaning of these terms enables stakeholders to determine ultimate success.

Given the FNC objective to make every S&T dollar count and deliver products to the fleet/force, the successful completion of a product at a technology readiness level (TRL) of 6 (i.e., system/subsystem model or prototype demonstration in a relevant environment) and its subsequent delivery to the acquisition community is only the first step on the path to the warfighter. The product requires additional RDT&E funding to mature the technology to a TRL of 9 (an actual system 'flight proven' through successful mission operations), which is the TRL level that is attained upon delivery of a fully supported product into the fleet/force.

To track the FNC program's effectiveness in deploying technologies to the warfighter, a transition review board (TRB) is chartered annually to conduct an independent and objective status assessment of all products delivered by ONR to its acquisition partners.

The TRB's objective is to determine whether products have been successfully integrated into their transition programs of record and are on track for deployment or have deployed to the fleet/force. The TRB begins to assess each product in the year immediately following the final year of S&T execution. This ensures continuity of reporting, as this is the year following the IPT's final transition assessment.

The TRB consists of senior Navy Reserve officers with relevant experience and expertise in the requirements, acquisition, S&T and/or test and evaluation communities. Meeting at ONR in the July timeframe, the board carries out its tasking by contacting and engaging the acquisition program offices (or other transition target offices) as documented in each TTA. Detailed documentation of these interactions is maintained.

The TRB assesses the transition status of completed products according to the following criteria:

- Deployed in the fleet/force
- Fully funded and being integrated into the target transition program
- Under consideration to be integrated without a fully funded or committed plan
- Failed transition

All products are reviewed annually until they are assessed as either "deployed" (blue) or "failed" (red). The TRB further assesses failed products to determine the cause of the transition failure, and has been instrumental in noting that significant value is often derived from products that fail to transition. If value was obtained, the TRB documents and categorizes the effort as:

- Partial transition success (some technology components deployed, but not the entire product)
- Other government service/agency transition (another service or agency transitioned the product, but not the targeted Navy or Marine Corps program of record)
- Reduced acquisition program risk (didn't transition, but helped the acquisition program make an important acquisition decision)
- Technology leveraged for another use

Through 2011, 62 percent of the products assessed as transition failures were assessed by the TRB as providing value. Figure 6 illustrates the results.

The TRB issues an annual report and briefing, which is presented to the CNR, who in turn presents the results to the TOG. This information is also made available to FNC stakeholders via an ONR collaborative workspace.

The TRB has conducted annual assessments since 2007. The resulting accumulation of data and statistics has formed an increasingly useful report card for the FNC program. Overall, the program's success rate is somewhere between 48 and 55 percent. This range accounts for the fact that some products are on track for deployment but have yet to deploy. Success rates for products ending in particular years vary widely. It is expected that these rates will increase in the future as a result of process improvements that have been implemented over the past several years.

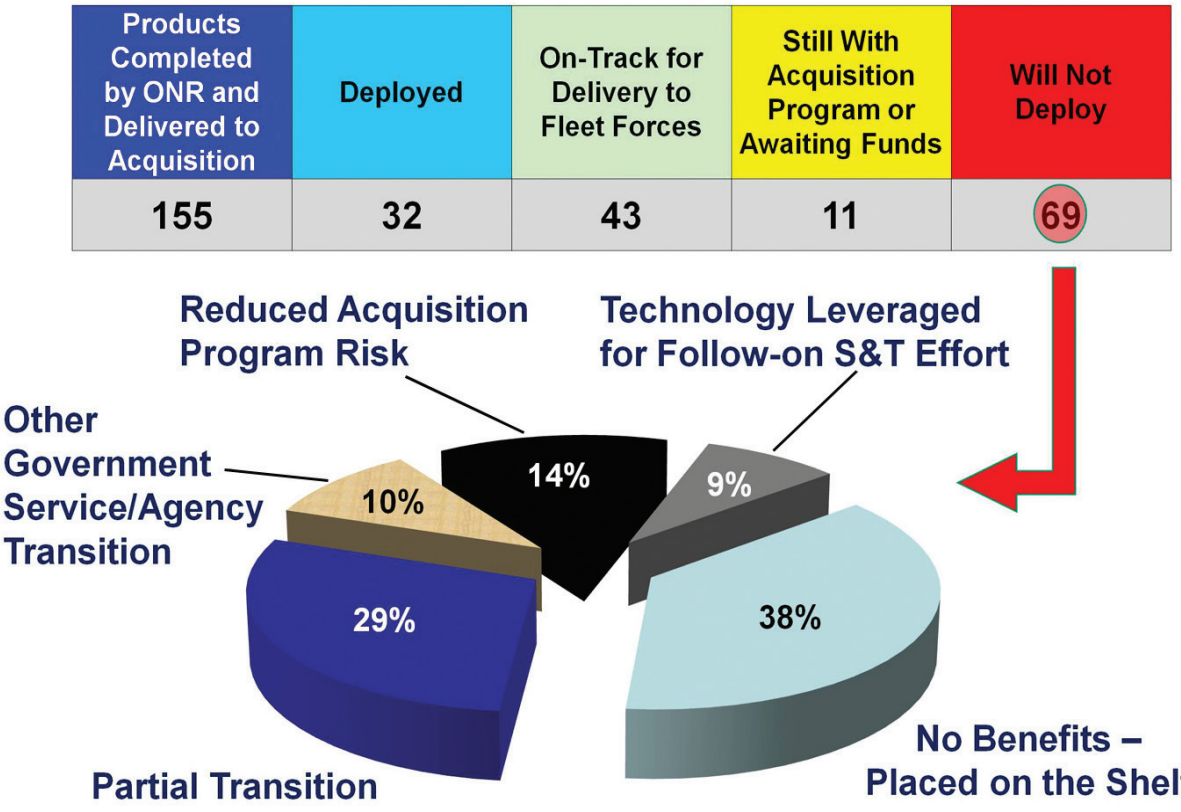
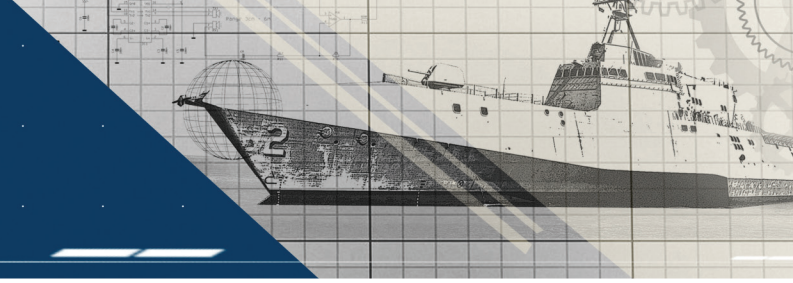


Figure 6 – Value of Failed Transistions

Training, Outreach and Documentation



Training

ONR provides a variety of training opportunities for stakeholders, both internal and external to ONR. The training includes strategic-and tactical-level information and guidance for all stakeholders and participants in the FNC process. It provides the necessary information to enable participants to understand their roles and responsibilities within the FNC program.

ONR's external training course is available to all Navy and Marine Corps stakeholders participating in the FNC program, including support contractors. The training focuses on program structure, oversight, requirements, investment strategy, program reviews and major events. During the three-hour course, a key emphasis is placed on TTAs and transition planning. ONR's internal training course focuses on execution management of ECs and products. This two-hour training lays out the FNC program schedule and explains the budget and financial management processes, business planning requirements, progress reports and EC/product manager responsibilities. The internal training course is intended primarily for ONR managers.

At the completion of each training session, participants are requested to complete surveys that critique the training and provide comments and/or suggestions for improvement. These surveys are assessed by the FNC staff and incorporated into future training sessions as appropriate.

In the spirit of transparency, the FNC program provides access to a large amount of current and archived documentation about all FNC investments via its collaborative website. New-start proposals, program review briefs, TTAs, ONR reports on transition programs, S&T capability gaps, business rules, IPTs charters and additional resources are available for download to military users with classified network accounts.

Industry Outreach

In addition to its annual transition reports, the FNC program participates in two large, ONR-sponsored special events: the biennial S&T Partnership Conference and the annual Navy Opportunity Forum.

The S&T Partnership Conference is intended to introduce and advance the awareness of ONR's S&T strategy and program initiatives, including potential business opportunities relating to FNC products. Current S&T focus areas are discussed to broaden the ONR's partnership base and explore new ideas.

The Navy Opportunity Forum showcases technologies developed by small businesses funded by the Navy's SBIR and Small Business Technology Transfer programs. These programs involve technologies that address naval needs across the S&T spectrum. EC and product managers review SBIR projects aligned to their technology interests to identify new, complimentary or alternate technology development paths. They attend the forum to discuss technologies of interest with small businesses.

Stakeholder Outreach

In addition to its training courses, ONR pursues an active outreach program to inform and solicit inputs from external stakeholders who have a role or interest in the FNC program. Twice yearly, ONR publishes a report on transition programs, which is aimed at fostering collaboration and coordination among stakeholders. This report, available only to stakeholders with classified network accounts, enhances stakeholder situational awareness of transition-related technology development programs. It provides descriptions, timeframes, transition alignment and other information concerning various S&T programs. Its availability is announced to a broad audience, including the Navy and Marine Corps acquisition and resource sponsor organizations, and includes the following programs:

- FNCs
- Rapid Technology Transition
- Technology Insertion for Program Savings
- Defense Acquisition Challenge
- Foreign Comparative Testing
- Technology Transition Initiative
- Innovative Naval Prototypes
- Joint Capability Technology Demonstration
- Defense Advanced Research Projects Agency
- SwampWorks
- TechSolutions
- Manufacturing Technology, or ManTech
- Small Business Innovative Research (SBIR)
- Speed to Fleet (S2F)

FNC Pillars

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C4ISR; networking; navigation; decision support; and space technologies that provide an architectural framework for naval warfare in the information age

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CAPABLE MANPOWER

The Capable Manpower (CMP) pillar focuses on three broad areas: manpower and personnel management; training and education; and human-systems integration (HSI). The primary objectives of the CMP pillar are to match Sailors and Marines to the right jobs, train for mission essential competencies, and aid in the design of intuitive systems. Technologies supporting manpower and personnel include modeling and simulation, and toolsets for manpower planning and optimization. Training-related FNC investments include performance assessment tools and metrics for training simulations that improve the quality of assessments for complex knowledge and skills; and tactical computer-based games for individual and team training that include the use of advisory languages in task-specific situations. HSI technologies include design toolsets and associated design processes that are able to link to product-specific configuration management engines to traditional design environments.

Automated Performance Assessment and After Action Review

POC: Amy Bolton **Email: amy.bolton@navy.mil**

Synopsis:

The Automated Expert Modeling and Student Evaluation (AEMASE) is a new "smart" software program designed to help naval aviators substantially improve their skills when training on flight simulators. The flexible program "learns" from performances by expert naval aviators and charts trainees' unique individual progress in real time.

Overview:

Naval aviators receive extensive training on flight simulators, learning mission awareness strategies and flying techniques for different aircraft. AEMASE (pronounced "amaze") is a machine learning software program that soon could dramatically improve this part of the training process.

AEMASE is a flexible program that not only "learns" from performances by expert naval aviators but charts trainees' individual progress in real time. It records trainee voices during sessions to monitor communication patterns, gives individual performance measurements, and provides aviators with specific ways to improve.

Currently in use for naval personnel training for the H-60 helicopter, the software soon will be used in training for the E-2C Hawkeye aircraft. Data based on this use has proven that it works: Students trained using AEMASE to learn how to operate the Hawkeye's battlespace management system outperformed their counterparts trained using standard simulators.

The "smart" and flexible aspects of the program makes it less likely to become obsolete, thus saving taxpayer dollars on new systems. It also frees both instructors and trainees to focus on flying techniques and individual areas requiring improvement.

Increasing naval aviator skills should also result in better use of actual flight time—perhaps even decreasing the need for some live flight hours, thus reducing fuel costs and aircraft wear and tear.

Benefits to the Warfighter:

- Allows instructors and trainees to focus on individual performance and needs
- Enables different scenarios to be more readily accessible to aviators and instructors and decreases the likelihood of program obsolescence
- Saves taxpayer dollars through more efficient training, reduced need for flight time and overall increased pilot skills

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ENTERPRISE AND PLATFORM ENABLERS

The Enterprise and Platform Enablers (EPE) pillar focuses on naval service platform and system costs (including acquisition, operations, and maintenance costs), naval service platform and system safety and availability, platform survivability, and cross-enterprise priority issues. Examples of FNC investments in this pillar include advanced coatings and components that decrease maintenance costs, increase operational availability, and extend the service live of vehicles and ships by reducing corrosion; a common, affordable, and scalable radar architecture project that provides significant capability improvements and reduces total ownership costs; an adaptive expert system that analyzes aircrew performance to detect human factors in mishap-related indicators; and desalination and pretreatment technologies that ensure the availability of water production in all environments, particularly the littorals.

Single-Coat Ship Tank Coatings

POC: Airan Perez
Email: airan.perez@navy.mil

Synopsis:

By using a new, long-lasting, single-coating protective system in ship tanks and voids, the Department of the Navy will save manpower hours and millions of dollars on maintenance costs. With faster application and drying time, the coatings will free up manpower and result in substantial cost savings.

Overview:

Fleet maintenance officers say that preserving ship tanks and voids—the empty areas between inner and outer hulls on double-hulled vessels—consumes 40 percent of all shipboard maintenance funds annually. The protective coatings installed on the majority of the fleet's ships require up to five applications and need to be reapplied every five years, if not sooner.

An ONR-developed system—the Rapid Cure Single Coating Systems for Enhanced Corrosion Control in Shipboard Tanks, known as single-coat ship tank coatings—will save the Department of the Navy millions of dollars over time by significantly reducing the cost and time associated with tank and void preservation.

The technology features a shorter application time, using one coat instead of five, and reduces application from 6-8 hours to as little as 15 minutes. In addition, the new coatings also will last longer. The service life on the single coatings for ballast and fuel tanks will be 20 years; the coatings for collection, holding and transfer tanks will last at least 10 years.

The savings of the new technology are dramatic. The rapid-cure coatings for shipboard tank and void corrosion control cost nearly 35-40 percent less than legacy systems. During a side by side comparison, a legacy three-coat system takes 216 hours to complete, compared to the 35 hours required for a rapid cure single coat application.

Benefits to the Warfighter:

- Reduces man hours significantly by minimizing maintenance and coating applications
- Frees funds for other maintenance and repair needs by saving 40 percent in overall production process costs
- Provides longer-lasting, more durable coatings
- Provides the Navy a fleetwide cost avoidance of $250M over 40 years

Quote from Warfighter:

"From the start in ballast tanks, voids, and chain lockers, single-coat paints have expanded their applications to fuel and collection, holding and transfer tanks, well-deck overheads, and even some bilges. The inherent ability of single-coat paints to provide up to a 20-year service life in tanks while reducing the time required to install the system are key components of the Navy's efforts to reduce total ownership costs."

Mark Ingle, P.E. SEA 05P2
Technical Warrant Holder, Coatings and Corrosion Control

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EXPEDITIONARY MANEUVER WARFARE

The Expeditionary Maneuver Warfare (EMW) pillar focuses on enhancing the warfighting capabilities of naval ground maneuver forces and individual warfighters. It delivers capabilities primarily designed for use at the small unit or individual level, with particular emphasis on enabling distributed operations and asymmetric/ irregular warfare. An objective of the EMW pillar is to increase the naval ground force maneuver element's survivability, mobility and sustainability, which is critical to maintaining an operational tempo that outpaces the enemy. FNC investments in this pillar include technologies for improved battlefield power generation; RF detection and directed energy neutralization of Improvised Explosive Devices; enhanced survivability/mobility of light armored and amphibious assault vehicles; reducing the weight burden of forces and warfighters in the field; and more precise munitions usable in complex terrain and urban environments.

Battlefield (Advanced) Power Generation

POC: Jeff Bradel **Email: jeff.bradel@navy.mil**

Synopsis:

The Onboard Vehicle Power (OBVP) system provides stationary and on-the-move exportable, utility-grade power for mission-critical systems that support expeditionary maneuver warfare (e.g., mobile command and control suites; radar and air defense sensors; and nuclear, biological, chemical and radiological sensors).

Overview:

From 2006 to 2009, ONR developed for the Marine Corps a prototype vehicle with a hybrid-electric drive system and integrated generator capability to provide the levels of power needed for today's modern expeditionary systems. In 2009, the Medium Tactical Vehicle Replacement (MTVR) OBVP prototype was delivered to Marine Corps Systems Command, Program Manager, Expeditionary Power (MCSC PM EXP) after having successfully completed power generation, mobility and environmental testing at the Aberdeen Automotive Test Center. As a result of its successes, in 2011 MCSC PM EXP awarded a procurement contract for 90 OBVP kits.

The system offers a quantum leap in stationary and mobile power generation for forward-deployed Marines—and will provide commanders the needed flexibility to plan and make decisions with respect to power generation through all the phases of a conflict.

The MTVR OBVP platform is equipped with an in-hub, hybrid-electric drive system capable of exporting up to 21 kilowatts (kW) of power while on the move without degrading the MTVR's mobility performance parameters. Also, when operating in the stationary mode, the vehicle's integrated generator can produce up to 120 kW of 208-volt A/C, three-phase, 60-hertz electric power which is enough to power six average-sized American homes or in a tactical sense, the largest field refrigeration and air conditioning units in the Marine Corps' inventory.

As a system, the prototype MTVR OBVP demonstrates quantifiable benefits over the 100 kW towed generator currently deployed by Marines. First, it delivers 20 percent more power than the 100 kW towed generator. Second, it can provide this power in environments and terrain that a towed 100kW generator would find non-navigable (i.e., fording depths over 3 feet). Finally, since the OBVP system occupies no cargo space on the MTVR, the vehicle's entire payload area remains 100 percent available for traditional logistic missions.

Benefits to the Warfighter:

- Enables many applications, including mobile command and control; radar; air defense sensors; nuclear, biological and radiological sensors; and operations centers
- Maintains platform capabilities (mobility, transportability, fuel efficiency) while providing military-specification export power for mobile and stationary loads
- Replaces towed systems, which minimizes the logistical footprint, improves power mobility and saves fuel

Quote from Warfighter:

"The purpose of the demonstration was to evaluate the system's tested performance with respect to requirements. After seeing the MTVR with OBVP in action, we're confident this system can greatly enhance the Marine Corps' capabilities in Expeditionary Maneuver Warfare."

Mike Gallagher
Program Manager Expeditionary Power Systems,
Marine Corps Systems Command

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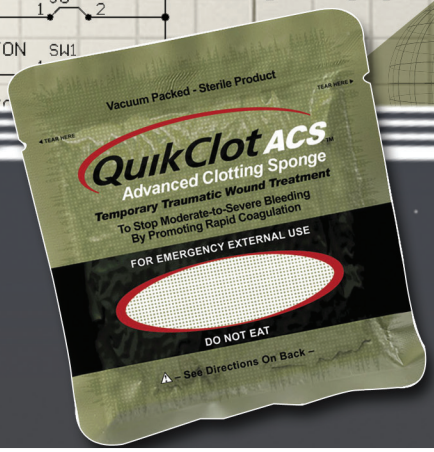
FORCE HEALTH PROTECTION

The Force Health Protection (FHP) pillar focuses on protecting Sailors and Marines by reducing fatalities and the consequences of injuries that occur. FNC investments in this pillar include technologies usable in the field for automated/semi-automated management of fluid delivery, oxygenation, ventilation, drug therapy and control of internal/external bleeding. Other capabilities being developed include devices and drugs for pharmacologic resuscitation; casualty and fluid warming; data acquisition, storage and transmission; mitigation of injury from blasts; hearing loss prevention and treatment; and improved wound healing. This pillar also invests in technologies to mitigate the effects of repetitive neurotrauma and post traumatic stress, and improve treatment outcomes by proposing changes to ship design, manning, and equipment configurations.



QuikClot® Advanced Clotting Sponge (ACS)

POC: Mike Given **Email: michael.given@navy.mil**

Synopsis:

QuikClot is a medical technology made from a porous mineral (zeolite) which rapidly soaks up water in blood. This action concentrates coagulation factors in blood at the site of injury to stop blood loss almost instantly, and can be used by anyone. It has become standard issue for U.S. Marines, who carry it on the field of battle, and is credited with saving hundreds of lives in theater and across civilian sectors.

Overview:

Approved for use in 2002, QuikClot is a medical product that, when applied to a heavily bleeding wound, almost instantly stanches the wound and blood flow. The product affords vital extra minutes for an injured warfighter to get to a medical facility for advanced treatment.

The chemically inert product speeds blood coagulation, creating a clot that can stop arterial bleeding. Recognized for simplicity and ease of use, the ONR-sponsored technology enables even those with no medical training to assist in cases of injuries involving severe bleeding.

Originally produced as a powder to pour into a wound, QuikClot evolved into an even easier-to-use sponge format. Today's version, Combat Gauze®, is coated with inorganic charged particles that accelerate the blood-clotting process. The newest product is effective in stanching wounds without generating any heat—a concern with the earlier, powdered version.

Today, QuikClot Combat Gauze is carried into battle by every Marine and has been adopted in some form by all U.S. military services. In addition, as with many technologies first developed by the military, the product can be in use among disaster relief workers, police officers, firefighters and private citizens in various trauma and first aid kits.

In recent months, ONR also has developed the Advanced Trauma Dressing (ATD), a hemostatic material that can be absorbed in the body with no need for removal. ATD received Food and Drug Administration approval in December 2011 for external use on arms and legs.

Researchers continue to explore the possibility of additional studies to obtain FDA approval for clotting inside the body as well, including during surgical procedures.

Benefits to the Warfighter:

- Used to stop severe bleeding easily, even in stressful situations
- Can be cost-effectively distributed to the warfighter, with a single application costing less than $20 on the commercial market
- Sealed in packages that are resistant to water or other damaging elements

Quote from Warfighter:

"It may not be perfect but there is no doubt that it has saved lives during this war. It is a great feeling to know that research that you were involved with actually makes it out to the field and helps the troops".

CAPT Peter Rhee, MC, USN (Ret)
Operation Iraqi Freedom

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FORCEnet

The FORCEnet (FNT) pillar focuses on developing new technologies for Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), networking, navigation, decision support and space technologies. It seeks to provide the architectural framework for naval warfare in the information age. FNC investments in this pillar include the development of agile sensors and communications enhancements that improve the tactical surveillance picture of forces in the field; new high-bandwidth communications capabilities that utilize free-space laser communications; improved surveillance and data collection technologies; new networking capabilities improving connectivity for mobile users communicating across mobile networks and differing security domains; improved situational awareness of global maritime forces; new communications capabilities that mitigate satellite vulnerability; new space technologies supporting asymmetric and irregular warfare; and proactive computer network defense technologies that will improve information assurance.

Improved Maritime Common Operational Tactical Picture in a GIG ES Environment

POC: Gary Toth Email: gary.toth@navy.mil

Synopsis:

With Sailors and Marines increasingly relying upon networked data to conduct missions, the ability to pull information from sensors quickly is critical. Software and algorithms developed by ONR-funded investigators have transitioned to distributed information operations systems to help commanders plan and execute missions by automatically detecting signals.

Overview:

Before executing any military operation, Department of Defense officials spend weeks and even months developing battle plans. To execute those plans, top commanders have at their disposal access to satellites, airborne sensors and other intelligence-gathering tools to inform their decisions.

The Department of the Navy employs a multitude of sensors and intelligence collection platforms to detect signals of interest over a regional operating area. Commanders must have a means to monitor, task, and sometimes re-task sensors to maintain up-to-date, useful information about the enemy.

ONR provided funding to develop software and algorithms that automate how warfighters choreograph sensors for data collection. The automation reduces the planning time to minutes and increases the probability of detection for signal intelligence needs.

Once the signals are detected, tactical sensors deployed aboard naval aircraft can maintain the tracks and identify key targets with certainty. The information then can be used for engagement purposes, reducing the exposure of friendly forces to hostility.

This technology was demonstrated in sea trials and at Empire Challenge, an exercise testing new intelligence collection and information-sharing tools. The software has been delivered to the Navy's Program Executive Office for Command, Control, Computers, Communication and Intelligence for integration into Navy Unified Cryptologic Operations (NUOC) Regional Combined Task Forces (CTF) and Ship Signal Exploitation Equipment, Increment E/F, shifting signals intelligence focus from large deck ships to the NUOC CTFs.

Benefits to the Warfighter:

- Helps Sailors and Marines automatically track and identify targets of interest
- Allocates tactical sensor resources effectively to complement intelligence coverage
- Reduces risk of friendly fire

Quote from Warfighter:

"Improved Maritime Common Operational Tactical Picture in a Global Information Grid Electronic Support Environment represents an ideal Distributed Operations Command and Control Module for Ship Signal Exploitation Equipment (SSEE)... It provides a framework to satisfy the Commander's vision articulated in the Navy Unified Cryptologic Operations roadmap."

Vice Admiral Michael S. Rogers

Commander, U.S. Fleet Cyber Command/ Commander, U.S. 10th Fleet

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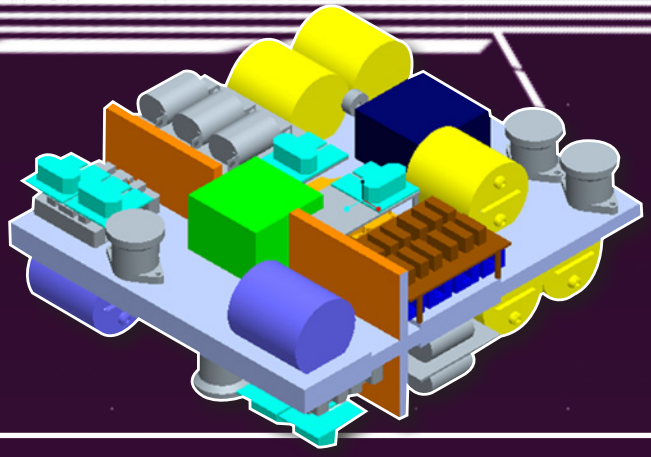
POWER AND ENERGY

The Power & Energy (P&E) pillar focuses on providing energy security, efficient power and energy systems, and high energy/pulse power generation in coordination with the Navy's Task Force Energy and the Marine Corps Expeditionary Energy Office. FNC investments in this pillar include technologies for a deployable thermal engine capable of utilizing existing and alternative fuels and concentrated solar thermal energy; a scalable, air-independent energy propulsion system capable of gas-and-go and rapid turnaround; a fuel efficiency demonstrator vehicle with an advanced engine, electric accessories, and electric drive capability; and advancements that provide a power-dense and highly efficient electrical backbone enabling high-power-demanding pulsed loads such as advanced radars, sensors and, potentially, directed energy weapons.



Bi-Directional Power Control Module (BPCM)

POC: Joseph Borraccini
Email: joseph.borraccini@navy.mil

Synopsis:

The Bi-Directional Power Control Module (BPCM) increases the amount of power available for the computers and electronics required by Sailors and Marines to do their jobs. It also enables new configurations for shipboard energy storage and power distribution, and increases the options available for emergency or distributed generation and energy storage.

Overview:

As today's ships and submarines carry an increasing number of computers and electronics to help Sailors and Marines perform their jobs, more power is needed to run these systems. To meet this need, a Bi-Directional Power Converter (BDPC) is being developed under the Compact Power Conversion Technologies Enabling Capability (EC). The EC's overarching goal is to increase power density in naval shipboard electrical power conversion applications.

The BPCM meets this objective by increasing the amount of power available by two to three times while also creating new configurations for shipboard energy storage and power distribution. This creates a power system for vessels that is potentially more capable and efficient than current systems.

Unlike conventional systems, the BPCM is bi-directional, meaning that power can flow in either direction to supply or store it. The versatility of this design allows it to be employed in a multitude of applications and meet the requirements of different system interfaces. Specific near-term applications include operation as the source converter for the new Air and Missile Defense Radar and the energy storage management system for USS Arleigh Burke (DDG 51). Other benefits include increasing options for generating emergency power and energy storage integration concepts. Present estimates indicate that the BPCM product will meet the threshold power density metric, which is twice the power density of similar equipment found on the Zumwalt-class destroyer (DDG-1000).

The BPCM will work with the Navy's Next-Generation Integrated Power Systems product, which was created to support increasing power demands by maintaining system reliability even when a component or the whole system isn't working.

Benefits to the Warfighter:

- Allows power flow from any devices connected to the power supply back to the circuit power supply
- Increases the number of options available for emergency or distributed generation and energy storage
- Enables power systems that are potentially more capable and more efficient than current ones

Quote from Warfighter:

"The Electric Ships Office plans to introduce Compact Power Conversion Products for future use on Navy surface combatants as well as to control Energy Storage Modules planned for backfit into existing ships for fuel savings."

CAPT Lynn J. Petersen
USN, Deputy Director, Electric Ships Office (PMS 320)

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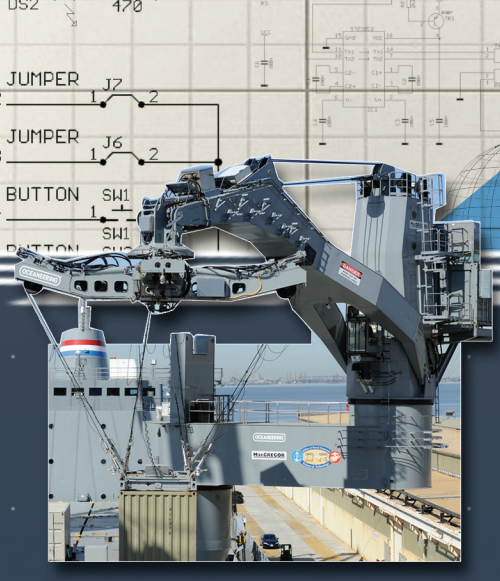
SEA BASE TECHNOLOGIES

The Sea Basing (BAS) pillar focuses on the optimal use of sea-based support for Expeditionary Forces by improving sea-to-land connector, at-sea transfer, and shipboard logistical capabilities. The sea base provides the joint commander with increased operational independence by moving logistical functions from land to sea. A primary objective of this pillar is to increase logistical support capabilities and capacity, particularly in high sea states. FNC investments include advanced cranes to transfer international organization for standardization (ISO) containers to and from various ships; advanced ramp technologies to transfer vehicles (including tanks) from ships to mobile landing platforms; automated mooring and positioning of ships to reduce workload, enhance safety, and increase throughput; and technologies to forecast wind, waves, and ship motions to support cargo transfer operations. Additionally, software such as logistics decision support tools enable real-time, adaptive and tailored logistics from the sea base to forces ashore.



Large Vessel Interface Lift-on/lift-off Crane (LVI Lo/Lo)

POC: Paul Hess **Email: paul.hess@navy.mil**

Synopsis:

The LVI Lo/Lo crane facilitates cargo transfer by allowing the movement of containers between ships while at sea in up to sea state 4 conditions. The system senses and compensates for the relative motions between the two ships and stabilizes containers during the transfer, making the process safer and easier, and eliminating the need for a secure deep-water port.

Overview:

Loading and offloading goods and supplies at sea can be slow and dangerous work. The ONR-sponsored LVI Lo/Lo crane and its supporting technologies work together to ease cargo transfer between vessels at sea by compensating for ship motions and keeping the containers steady or matches the container and ship motions, without use of taglines held by ship's crew.

The crane is made up of a "system of systems" that surpass the capabilities of technologies currently used in the modern marine and material handling industries. Its main components include a crane; a sensor suite to detect the position and motion of the crane, cargo and ship; and a control system that automates the crane's movement.

The crane has two main subsystems: a "macro crane" arm that attaches to the ship to help control big movements, and a "micro crane" that controls the remaining motion. The micro crane uses an eight-wire inverted Stewart platform that attaches to the top of a standard shipping container to prevent it from rotating or swinging during the lift. The whole system can achieve accuracy to within inches, eliminating the need to reposition the container repeatedly.

To transfer cargo, ships pull up alongside one another and either stop or continue ahead slowly. The crane system's motion sensing and compensation technologies constantly calculate the ships' movements to actively control the containers during transfer, matching the container's motion to the motion of the deck upon which it is to be placed. Because the transfer can be done at sea, there is no need to find a secure port in waters deep enough to accommodate a large ship or cargo vessel.

LVI Lo/Lo works with standard containers and can be used with military or commercial ships. The system's efficiency reduces the manpower involved in container lifts from an average of nine staff down to three, and uses energy storage technology to reduce peak power consumption.

Benefits to the Warfighter:

- Allows containers to be moved from ship to ship without having to find a secure, deep-water port
- Allows container transfers in higher sea states thus increasing the operational window.
- Makes cargo transfer safer and more efficient with motion sensing and compensation technologies

Quote from Warfighter:

"The LVI crane system enables confident cargo handling under conditions where it would be otherwise difficult or impossible. It increases cargo transfer capabilities as measured by a higher transfer rate and increased load capabilities. Damage from swinging loads and the risk to cargo handlers are greatly mitigated as the load is effectively stabilized."

CAPT Joe Regan, of the SS Flickertail State

(The SS Flickertail State is a ship managed by MARAD on behalf of the DoD; a 2010 at sea demonstration of the LVI Lo/Lo system onboard the ship changed their initial skepticism to enthusiasm about the potential future impact in performance and safety after seeing what the system could do.)

FNC Pillars

Capable Manpower:

Intuitive systems and personnel tools for matching Sailors and Marines to the right jobs and training for mission-essential competencies

Enterprise and Platform Enablers:

Cross-cutting technologies to lower acquisition, operations and maintenance costs

Expeditionary Maneuver Warfare:

Naval ground forces with special emphasis on regular and irregular warfare

Force Health Protection:

Medical equipment, supplies and procedures to reduce morbidity and mortality when casualties occur

FORCEnet:

C4ISR; networking; navigation; decision support; and space technologies that provide an architectural framework for naval warfare in the information age

Power & Energy:

Energy security, efficient power and energy systems, high energy, pulse power

Sea Basing:

Logistics, shipping and at-sea transfer technologies that provide operational independence

Sea Shield:

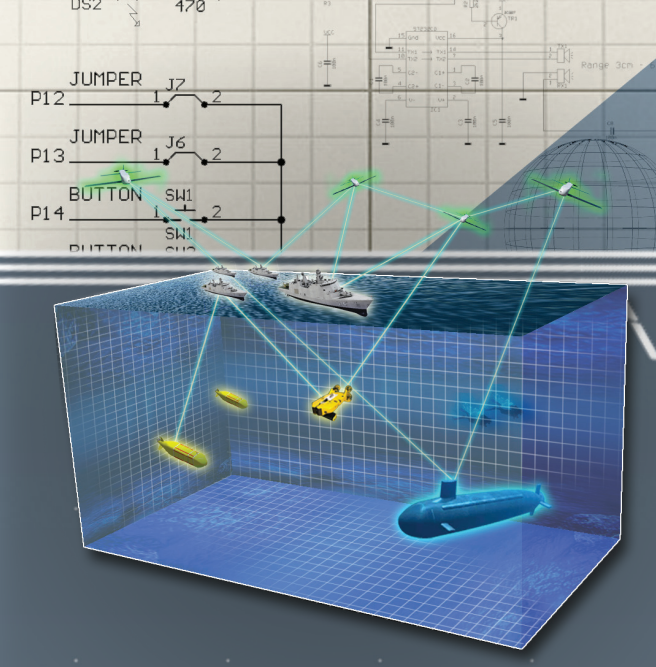
Missile defense, antisubmarine warfare, mine warfare and fleet/force protection technologies that provide global defensive assurance

Sea Strike:

Weapons, aircraft and expeditionary warfare technologies that provide precise and persistent offensive power

SEA SHIELD TECHNOLOGIES

The Sea Shield (SHD) pillar focuses on global defense assurance in four major areas: theater air and missile defense (TAMD), anti-submarine warfare (ASW), mine warfare (MIW), and defensive surface warfare and anti-terrorism/force protection (DSW/ATFP). Each of these areas is addressed by a sub-IPT. FNC technology investments in TAMD include the force level radar management and coordination of radar resources for increased search, track and engage efficiencies. ASW technologies involve knowledge products such as automation algorithms for operator alerts to provide improved acoustic detection and classification, and hardware such as an affordable, buoy-based, and persistent system for the detection and classification of diesel-electric submarines. FNC products addressing MIW consist of autonomous undersea vehicle technologies for the reacquisition and identification of mines in very shallow water and the surf zone, and breaching mission planning software, among many others. Examples of DSW/AFTP-related technologies include advanced electronic attack technologies and techniques to protect surface platforms from modern threats; and video based electro-optic and infrared surveillance systems incorporating robust target activity recognition that provide automatic alerts of incursions across virtual perimeters and violations of specified rules on activities.



Placement of Active ASW Distributed Systems (PAADS)

POC: Dave Johnson **Email: dave.h.johnson@navy.mil**

Synopsis:

Through the use of advanced algorithms, the PAADS program has become a vital tool for the warfighter, maximizing the efficiency of sonobuoys in detecting the enemy and rapidly processing large quantities of data to plan, execute and evaluate mission success.

Overview:

Navy and Marine vessels and aircraft depend on accurate tactical information to locate enemy vessels and mines. Some of that data is retrieved from shallow and deep-water sensor systems, facilitated by sonobuoys.

As cutting-edge technologies have been adapted by the fleet, data flow has increased exponentially compared to earlier eras—making it more difficult, yet more essential than ever, to assimilate and take advantage of new information for strategic planning.

PAADS technology provides the warfighter with an improved flow of more accurate and accessible information. The system helps planners tie together the various phases of an operation, automatically distributing information from pre-mission planning to execution and post-flight analysis.

In addition to helping ensure mission success and accurate assessment, the improved use of sonobuoys has also been cost-effective. PAADS was integrated into the fleet's existing TACMobile computer architecture, enabling it to be tested and transitioned quickly. Additionally, in the long term, improved placement of sensors helps lower overall costs, as missions are more swiftly and successfully accomplished.

The system also has lessened computation time, resulting in reduced warfighter workload. Prior to PAADS, the Navy had separate efforts to plan for missions, conduct missions and do post-flight analysis, and connecting these steps was extremely time-consuming.

Benefits to the Warfighter:

- Frees the aviator from having to enter information by hand, saving time and eliminating potential entry error, thus contributing to mission success.
- Reduces the time required to obtain larger amounts of information, helping mission planning and evaluation and reducing operator workload
- Maximizes the effectiveness of buoy field deployment

Quote from Warfighter:

"The biggest payoff I see that PAADS offers the warfighter is greater accuracy of mission planning and mission evaluation at reduced effort and timelines leading to more effective use of multi-static sonobuoy fields."

Robert Miyamoto
PAADS Project Officer, Applied Physics Laboratory,
University of Washington

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SEA STRIKE TECHNOLOGIES

The Sea Strike (STK) pillar focuses on developing new weapons, aircraft, and expeditionary warfare technologies to enable precise and persistent offensive power for naval missions that involve power projection and deterrence. FNC investments in this pillar include technologies for next-generation electronic warfare attack systems; better target identification at range in adverse weather; an ability to distinguish targets in cluttered environments; counter air/counter air defense technologies; improved electro-optic, infrared, and radio frequency countermeasures; increased helicopter survivability in degraded visual environments; a cockpit selectable variable effects weapon; an airborne platform to perform simultaneous laser designation for multiple targets; engaging multiple moving and stationary surface targets in a littoral environment; improved submarine survivability against surveillance radars; a high-energy fiber laser system; non-lethal hostile fire suppression; and multiple subsystem improvements to the Sidewinder missile system.

Low-Cost Imaging Terminal Seeker (LCITS)

POC: Kenneth Heeke **Email: kenneth.heeke@navy.mil**

Synopsis:

LCITS is a suite of low-cost technologies that modify existing helicopter-borne rockets into precision-guided weapons. Unlike laser-guided weapons that require operators to select and monitor a target from launch to detonation, LCITS gives 2.75-inch Hydra-70 rockets the ability to compute and home in on targets automatically after launch.

Overview:

Following the attack on USS Cole in the Yemeni port of Aden in 2000, the Department of the Navy refocused its efforts to counter small boat threats to ships at sea as well as in ports and harbors. Officials sought better ways to address potential attacks from multiple speedy vessels.

Sailors and Marines have access to precision-guided weapons that can be launched from helicopters and other aircraft to eliminate enemy targets in the water. But even with laser-guided weapons, operators must designate a target and maintain their sights on that target until munitions hit, leaving them exposed to threats as they execute their missions. Warfighters would rather fire a weapon that is smart enough to seek out an intended target autonomously.

ONR researchers produced a suite of low-cost technologies to modify existing helicopter-borne rockets into precision-guided weapons. By adding an infrared imaging guidance section to 2.75-inch Hydra-70 rockets, the researchers are providing naval aviators with a new lethal capability.

LCITS provides a guidance capability to the unguided rockets through an inertial and imaging infrared guidance subsystem. After launch, the rocket flies to a point in the sky using inertial guidance. The infrared terminal guidance system then takes over, using onboard imaging infrared seekers to identify intended targets.

A weapon prototype developed by ONR successfully hit two high-speed boat targets during testing in November 2011. In the test, Naval Air Warfare Center Weapons Division engineers used a shore-based launcher to fire two LCITS rockets, one inert and the other with an explosive warhead. Onboard imaging infrared seekers identified their intended targets among five maneuvering small boats. The rockets adjusted trajectories to intercept and eliminate two of the boats.

Benefits to the Warfighter:

- Provides a low-cost, “fire-and-forget” weapon
- Enables the ability to counter small boat swarm tactics in ports and offshore
- Reduces the target engagement timeline to 15 seconds or less

Quote from Warfighter:

“Putting this on a helicopter gives us the ability to take the fight away from the boat. The LCITS technology appears to be well suited for engaging multiple, high-speed seaborne targets in a very short period of time.”

Lt. Col. Raymond Schreiner
Developmental test pilot, Naval Air Warfare System Weapons Division in China Lake, Calif., as stated in a May 11, 2011, article in ScienceDaily.

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