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**THE JOINT TRANSPORTATION ROTORCRAFT (JTR)  
ITS CONTRIBUTION TO FUTURE JOINT WARFARE**

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ABSTRACT

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The Force XXI Army of the 21st Century will be composed of numerous mobile customers requiring frequent and near simultaneous servicing from limited inventories. Combine the new force with the expected greater velocity and asymmetry of the future battlespace and it becomes absolutely critical to move, redirect, and redistribute supplies at speeds never before envisioned. This study will explore the many contributions and efficiencies the JTR can bring to the future force.

# THE JOINT TRANSPORTATION ROTORCRAFT ITS CONTRIBUTION TO FUTURE WARFARE

## INTRODUCTION

This paper demonstrates the need for the future Joint Transport Rotorcraft (JTR), a tri-Service air vehicle venture. The program is designed to address the aging cargo helicopters problems of obsolescence, rising operating and support costs and mounting incompatibilities with 21st Century technology. While also highlighting its applicability for employment in the 21st century battlespace, further contributions the JTR can make to the considerably smaller future Force XXI Army are examined. Lastly, efficiencies or economies are identified that may result from joint development and procurement of the JTR.

### Background

History is replete with examples of failure in battle caused by a lack of pre-war logistical planning, or the inability, once a conflict has started to provide the means by which to get the required supplies quickly to the combat force. It is well known that Napoleon's "Grande Armee" was forced on several occasions during its advance to Moscow to resort to requisitioning. Again, "in 1870 and in 1914, the Germans with their immeasurably superior and excellently organized supply apparatus utterly failed to feed their armies from base and had to resort to requisitions, in spite

of the fact that the distances involved were smaller by far, the roads available very much better and more numerous."<sup>1</sup> Today's technology, and surely that of the future Force XXI Army, prevents us from requisitioning along the lines of communication as was done in the past. Few, if any Weapons System Processors (WPS), Global Positioning Systems (GPS), composite main rotor blades, or Multiple Launch Rocket System (MLRS) components will be found in the wadies, fields, forests or jungles of the future battlespace.

Once the war has started, it is far too late to begin logistical provisioning and preparations. Eleventh-hour improvisation, crisis management and ad hoc decision making will no longer carry the day as we move into the 21st century. When called upon, the logistical machine must be ready, warm, primed and strategically positioned to respond. It is highly unlikely that we will ever have the time or see again a build up of forces such as occurred in Desert Shield and Desert Storm or as was seen in World War II England, during operation Bolero, from 1942-1944. In the future there may not be an England or Saudi Arabia from which to base, nor will we or should we plan on host nation support as robust as was present in Saudi Arabia.

As future conflicts are likely to erupt overnight, we must begin now to recapitalize and redefine the logistical and transportation paradigm. We can never again use the

excuse that there is no time or that there are not enough soldiers to build the needed transportation and logistical structure. If we can glean any one logistical lesson from the desert, it is that as we transform into a future force projection Army we must become more efficient, logistically capable and self reliant. "In the new style of war, superior logistics becomes the engine that allows American military forces to reach an enemy from all points of the globe and arrive ready to fight."<sup>2</sup>

#### **WHY THE JTR IS NEEDED**

As we learned lessons from Desert Shield and Desert Storm, so too, did our enemies. They grudgingly acknowledge and recognize our ability to globally project forces more rapidly than all others, yet they also note that we are presently hampered by a necessity to wait for or work through an ad hoc transportation and logistical system once combat forces arrive in theater. This prevents our quick entry into battle and increases both our vulnerability and force protection requirements.

JTR will contribute to correcting these deficiencies along with improving the effectiveness of early arriving forces. It will assist with the movement and dispersing of combat forces and supplies quickly, away from ports and airfields or from off shore staging areas. This will help reduce force vulnerability to attack by weapons of mass

destruction launched by much smaller or less capable forces. With its in-flight refuel and self deployment capabilities, JTR will possess the capability for early entry into a major theater, or lesser regional contingency, thereby contributing significantly to maintaining the momentum of the force while simultaneously reducing air and sea lift requirements. If required, entire JTR units composed of logisticians and transporters could be strategically pre-positioned with other pre-positioned stocks, further enhancing the ability to respond in times of crisis. As we noted in Desert Storm, "the conscious decision to defer the deployment of logistical troops in order to increase the flow of combat forces into the theater of operations seriously complicated the provision of adequate logistical support."<sup>3</sup>

Some argue the pause experienced in Desert Storm was planned to allow the air campaign to achieve its objectives, however, we also know that it bought precious time to deploy sufficient force into theater. In future conflicts we may not have as accommodating or ignorant an opponent as Saddam, and even he assuredly learned several lessons from his failed venture. "Had Saddam seized the opportunity to attack through to as-Dammam in late August, the 82nd might have held off his tanks with TOW'S and Dragon missiles, but the cost may have been unacceptably high."<sup>4</sup> To address this

weakness in force projection we have committed to the procurement of inter-theater strategic assets. We must now complete the equation, commit our energies and spend the dollars necessary to insure future success by investing in the intra-theater transportation assets as well.

Previous battles teach us that once a lodgment has been secured, it is best to immediately maintain the momentum of the operation. Given the President's National Security Strategy of Engagement and Enlargement, requiring increasing numbers of world wide deployments with fewer forces, it is becoming extremely difficult for U.S. forces to quickly mass, and then maintain momentum. Napoleon knew that pauses in one place for too long lead to disaster. His ability to "go straight on from strategic march to battle and then to pursuit,"<sup>5</sup> not only avoided sieges in his day, but also allowed him to maintain the momentum. JTR will contribute immeasurably to maintaining force momentum, reduce force protection requirements, and place credible velocity into a maturing yet still somewhat sluggish velocity logistics system.

With smaller forces and higher operational tempos time spent waiting on the logistical system, especially one backed up with much smaller inventories, greatly increases risk of failure. Without a doubt, the future battlespace intra-theater transportation system must be totally

responsive to the needs of the smaller force in order to maximize combat power. Although predicted to be more lethal, "Washington will have less of a margin for error in its future force deployments as the smaller force will be more dependent than ever before on the transportation system."<sup>6</sup> One wonders if we can achieve continued success with the smaller force, given recent initiatives that have reduced inventories across all Services, consolidated depot operations, reduced both soldier and civilian force structure, and applied the two level maintenance concept to many of our most lethal and sophisticated weapon systems. But no matter what the size force, inventories or chosen maintenance concept one thing is certain, future success will not be achieved with today's methods or assets. Without creating new paradigms in intra-theater transportation and making further investments in assets such as the JTR we are subject to failing, far short of our objectives.

#### **JTR CONTRIBUTIONS TO THE FUTURE BATTLE**

The war in the round battlespace of the future will be unlike anything we have experienced in the past. While extremely sophisticated weapon systems with costly precision munitions may decrease the volume of ammunition, fuel and other supplies to be transported, the fluidity, dispersion and uncertainty of the new battlespace of the future will

require the logistical system to respond more quickly than it has ever been able or required to do in past conflicts. Numerous mobile customers will require frequent and near simultaneous servicing, placing great stress on the transportation and logistical systems. Reduced inventories, combined with the velocity of the battle, will make it absolutely critical to move, redirect, and redistribute supplies across the battlespace at speeds never before envisioned. Seamless, velocity logistics must become a reality, as the "Brute Force Logistics"<sup>7</sup> witnessed in the desert will only lead to defeat and disaster in the future. Total asset visibility (TAV) as well as one day response time from the States will be absolutely essential, if we are to achieve success with a much smaller, albeit more lethal force. Desert Shield and Desert Storm was not a dress rehearsal, but a wake up call, to make the required changes necessary to support the future force. Dramatic and dynamic changes are mandated to insure success in the future.

The rapid development, procurement, and integration of the JTR, into the future intra-theater transportation force structure is highly recommended if we are to achieve the Army's Velocity Management goals of "substituting velocity and accuracy for mass in the logistics system."<sup>8</sup> Transportation enablers, like the JTR, with far greater agility and flexibility over current transportation assets

must be given greater emphasis and budgetary priority.

"Current readiness has to be balanced with the investments required for modernization and future readiness."<sup>9</sup>

Capable of contributing not only to the reception of forces in theater, but also to their onward movement, the JTR will, in a very fluid, volatile and uncertain environment, help to sustain the force both before and during combat. As George C. Thorpe in 1917 envisioned in his book, *Pure Logistics: The Science of War Preparation*, "logistics as never before will exist as a coequal with strategy and tactics."<sup>10</sup> No truer statement could be made today about our future. Success or failure in the 21st century battlespace will rest squarely on the logistician and transporter's shoulders. In future conflicts the ability to rapidly distribute critical assets across all levels of war, tactical, operational and strategic, will spell the difference between victory and defeat "In years to come, the single most distinguishing characteristic of joint land combat will be the presence of aerial vehicles from every Service and in support of every battlefield function."<sup>11</sup> Just imagine the velocity a JTR could add to the onward movement or replenishment of the force with onboard systems that would readily identify one container and its contents from another. A hovering JTR could, within moments of cargo arriving in port, sling load the containers

to their intended onward movement staging area. The JTR would not only expeditiously deliver containers for arriving forces but also assist in the continuing problem of rapid resupply of the force once engaged and underway. The technology to accomplish this is here today, we need only make it happen.

Exceptional mobility, lethality and reportability characterize future forces. Units, and in many instances individual weapons systems, will have the capability to report status or be remotely queried as to numbers of MLRS rockets launched, gallons of fuel consumed, or Hellfire missiles expended. "Information technology will improve all four steps of the see, prioritize, assign and assess information cycle."<sup>12</sup> Consequently, logisticians monitoring the battle will know what is needed and then orchestrate the placement of fuel and ammunition or whatever supplies are required quite literally even before a unit commander requests delivery. In order to accomplish this, the logisticians will require a fleet of transportation enablers such as the JTR, directly under their control. The transportation officer in coordination with the logistician will employ these assets both in depth and breath across the conflict spectrum to maintain the velocity of support, future units will need to win.

As key members of future, leaner and more agile digitized battle staffs, logisticians and transporters digitally synchronized into the battle, will create greater flexibility for the combatant commander. With their fleet of JTR's integrated with other ground force transportation assets, logisticians will be able to predictively push and place supplies about the battlespace for the commander, allowing him to concentrate totally on the fight.

"Operating under a concept of assured support, the customer (commander) will have the assurance of required support on time, where required, with the proper quantities."<sup>13</sup>

"Currently, America's strategic mobility capabilities are hinged on a critical triad, consisting of inter-theater strategic Airlift, Sealift and pre-positioned afloat ships."<sup>14</sup> The concerted mobility efforts to date, and where the procurement dollars have been invested, is on this strategic triad. These enhancements while excellent, and also urgently required, "are geared especially toward ensuring that U.S. forces will be able to bring a large amount of firepower to the conflict in its opening stages and quickly halt the aggression."<sup>15</sup> However, it does little good to possess such a global capability to rapidly transport soldiers, weapons and supplies, if once in theater, they sit stagnate for lack of intra-theater transportation. This becomes even more critical once the

force moves away from initial entry ports and airfields. If our Army is to be successful in implementing future National Military Strategy, both sides of the transportation equation, inter-theater as well as intra-theater transportation must be addressed.

A highly mobile, timely and focused means of transportation, is required to move both forces and "modular and specifically tailored combat service and service support packages"<sup>16</sup> about the battlespace. If we attempt to rely on old methods and models then all the joint planning, Force XXI enhancements, advanced munitions and sensors, enhanced long range bombers and greater carrier based Airpower will be for naught. Without the means available to continue the fight once in theater, the ground force will fail. If our forces are to dominate the future battlespace, rapid transport of troops and replenishment supplies will be absolutely critical to achieving success. The JTR will contribute immeasurably to moving and building forces faster than any future adversary.

Unfortunately, it appears that as we undergo transformation and reengineering into a force projection Army, we continue to neglect or fail to consider in our plan for transportation and mobility enhancements, the vital area, of intra-theater transportation. Immediate steps must be undertaken to break the old model and build the new

paradigm. As we are now in the process of creating a new paradigm for information warfare, so too must we create a new paradigm for intra-theater transportation and force replenishment. I propose that the strategic mobility triad add a fourth leg to its paradigm, that of intra-theater transportation.

TRANSCOM must begin to look more closely at this piece of the equation if we are to achieve success in the future. It requires rethinking and revising the paradigm to make it applicable to the future force. The task of reassessment can not be left to the Geographical CINCs; they simply do not possess the staff, time or expertise necessary to accomplish the effort.

Much more must be done if the smaller, but more lethal Force XXI units are to reduce their logistical response times. As was evidenced in Desert Shield and Desert Storm, "the Army's shortages of surface transportation assets, including heavy-equipment transports, tractor trailers, and material-handling equipment limited the service's ability to transport equipment and supplies."<sup>17</sup> Material handling in particular was "identified as a critical shortage,"<sup>18</sup> which over time, if not corrected can seriously threaten the smaller force. JTR has great potential to make significant contributions in this area by acting as a mobile crane and delivery system.

When rough terrain handling vehicles are prohibited from accomplishing their mission either by weather, extreme terrain, mines or employment of weapons of mass destruction (WMD) the JTR will accomplish rapid force resupply. The amount of supplies might not be as great as could be delivered by ground assets but the key aspect is the force will get critical supplies sufficient to sustain the operation. Employed in this manner, the JTR is not only a force provider, but also a force protector.

We already knew there were limits to our intra-theater capabilities when deployed with modern combat systems like the Abrams and Bradley, but our reliance on age old transportation methods were glaringly displayed to us and the rest of the world in Desert Storm. This was very evident when "McCaffery's lead elements stood on Highway 8, while the Divisions tail stretched 300 kilometers back to the original assembly area."<sup>19</sup> Modern combat forces are capable within just a few hours of outrunning their transportation assets. "Desert Storm demonstrated that a serious gap in ground mobility still exists between direct fire combat systems such as the Abrams and Bradleys, and systems that make up the following echelons."<sup>20</sup> If immediate steps are not taken to correct this deficiency, achieving dominate maneuver in the future will remain

elusive and just so many words written into a document called "Vision 2010."

New trucks alone, now under procurement, are not the answer, as they simply will not be able to deliver the supplies quickly enough about the dynamic future battlespace. There is however, still a requirement for heavy transport trucking, but their best utilization will be in transporting supplies away from highly secure airfields and ports, onward to multiple secure logistical staging areas. From there the JTR will rapidly redistribute them about a fluid, variable tempo, non-symmetrical battlespace. In future conflicts we can ill afford to repeat what occurred during the early stages of Desert Shield when "the magnitude of items arriving in theater overwhelmed the supply personnel at staging areas and warehouses in and around the ports of entry."<sup>21</sup>

We must remember that "on the digital battlefield, friendly forces need not be in physical contact with each other and may be oriented in different directions."<sup>22</sup> The symmetrical battlefield of the past may not be always feasible or best suited to future warfare as many operations will occur independently, separate from the main force. The JTR's ability to operate in the 3rd dimension over impassable terrain, or around maneuvering enemy forces is ideally suited to resupplying the force of the future. It

is not so much a matter of competition between trucks and the airborne JTR, as it is creating a new paradigm where one asset compliments or furthers the others capabilities and strengths.

As the force gets smaller we must work harder to create greater teamwork and integration, not only within our own Army, but also among the other Services. With Force XXI units predicted to move considerably faster and more frequently, their increased capabilities will only further compound and exacerbate an already glaring intra-theater transportation deficiency if we hold to the old paradigm.

#### **EFFICIENCIES OR ECONOMIES TO BE GAINED THROUGH**

#### **JOINT PROCUREMENT AND PRODUCTION OF JTR**

As the Army and other Services downsize, we must look for means by which to gain economic advantage and operational efficiencies or both, in procuring future weapon systems or support assets. Knowing that we will face similar, multiple and near simultaneous ongoing operations in different parts of the world in the future, we must begin now to procure intra-theater transportation assets that will contribute to success, such as the JTR. Better preparation and capabilities are required to solve problems like those experienced at the ports, airfields and along the main supply routes (MSR's) in Saudi, if our restructured smaller force, is to successfully fight and win the next war.

Every Service must do its part. Instead of each Service spending money on multi-system upgrades of older, obsoleting aircraft, Services must now attempt to "lean the spares and modernization accounts because that bleeds money away from new procurement."<sup>23</sup>

One way to shrink spare inventories and save modernization dollars is through Joint development and production of a common system to be used by all Services. Long recognized as feasible, yet difficult to execute as a means of gaining efficiencies, joint programs when properly implemented, "should lower unit price through savings in set up costs, learning curve impacts, special tooling and quantity production or procurement of unit components."<sup>24</sup> By committing up-front to longer production runs and greater quantities, the government can often gain leverage with manufacturers, as they in turn obtain better prices from their vendors for the guaranteed production, which ultimately reduces the price. Using this type of strategy should help reduce the development and production costs associated with the JTR.

Additionally, by taking advantage of previous non-recurring engineering efforts and leveraging technology from systems like the AH-64 Long-Bow Apache, RAH-66 Comanche, V-22 Osprey and recently acquired MH-47 Special Operations aircraft we will save dollars while at the same time

providing a strong foundation and start point for JTR. Through technology leveraging, concurrent engineering, and virtual factory manufacturing, savings will be readily achieved in the areas of systems architecture, composite material, engines, transmissions and previously integrated mission equipment packages. The benefits to using this approach are "lower research development and acquisition costs, lower operation costs, shorter development time, less cost for startup and less rework."<sup>25</sup> Further efficiencies can be achieved in these areas if we incorporate proven best commercial practices, and where it makes sense, commercial specifications. By taking advantage of all previously funded and developed hardware and software, significant reductions should be realized in the development and production of the JTR.

Next, long term savings in operation and support costs may be achieved once the jointly developed and produced cargo transporter is fielded. A commonly designed aircraft system, like the JTR, will mean significant savings in common spares and support costs. A common system suggests a potential benefit arising from greater standardization between Services, "as they will need considerably fewer war reserves as routine peacetime demand will be sufficient to sustain spares for helicopters which are part of large fleets."<sup>26</sup> Consolidation of spares will further contribute

to efficiencies as many or all can be served by one depot support operation. Although not a joint program, the precedence was set by the U.S. Air Force in going to one common airframe, when it decided to fall in behind the C-17 as "the" airframe to accomplish future strategic airlift missions. Numerous similarities and arguments can be made between the C-17 decision and the decision that must be made to go to the JTR, as "the" one transport cargo helicopter system for all Services.

Several parallels exist such as age and obsolescence problems experienced in the strategic airlift fleet, especially the C-141, and the many aged cargo helicopter assets now present in all Service inventories. Leaving the comparison aside, there is still good argument for the JTR based solely on the multiple helicopter fleets extended ages, obsolete technologies and inability to perform in the future battlespace.

Replacement of the CH-46, CH-47, and CH-53 fleets is more than justified. Continuing to maintain insupportable, expensive, nearing obsolete fleets, just doesn't make good economic sense. More importantly, these older less capable systems "are not compatible on the digital battlefield and cannot support increased mission profiles"<sup>27</sup> required by the emerging battle dynamics. With greater optempos and battlespace dispersion of forces made possible by the Force

XXI technology, cargo helicopters will be required to fly more tons of cargo per day, faster, over greater distances and with greater scheduled availability rates. The older systems that the Services now possess, although excellent workhorses in their time, simply are not capable of maintaining the pace required in the future.

Looking further ahead, there are several more recurring benefits to be gained by procuring a large common fleet. First, by maintaining a warm production base we decrease the response time for spares and critical components during national emergency. Although difficult to place a price tag on during peacetime, a warm production base becomes invaluable during times of conflict. Second, by creating a large common fleet, the likelihood of foreign military and commercial sales increases due to the reduced price gained by larger production runs. Third, as the opportunity for joint and coalition warfare increases, the benefit of a common system across many different Services, countries and continents is evident. The synergy created through the use of a common cargo helicopter will provide enhanced readiness and system availability as spares and replacement components can be exchanged or made available through previous agreements between coalition partners.

If proof of the many benefits to be harvested from a large common fleet is required, one need only look to the

many successes, commonalties and efficiencies gained between the Army's UH-60 Black Hawk, the Navy's SH-60 Sea Hawk programs and the numerous allies who have opted to purchase the many Hawk variants now available. Japan, Australia, Korea, Jordan, Turkey, and Israel are just a few of the countries who have to date reaped the benefits of a large fleet and decided to procure the Sikorsky product. Using the Black Hawk and its variants as a paradigm for the JTR holds tremendous potential.

Additional significant savings and benefits in initial training can be realized if all training for the JTR is conducted at a consolidated location, utilizing one fleet of training aircraft, simulators and instructor pilots.

To assist in the rapid fielding of the JTR instead of retiring the old cargo aircraft immediately, the newest of the old would move to the training base and to be used as trainers, accruing further savings. With "advancements in avionics and electronics that have made possible such innovations as programmable fly-by-wire control systems which allow one aircraft to have the flight characteristics of another,"<sup>28</sup> the older cargo fleet could initially substitute at the training base for the new JTR's, shortening the time to First Unit Equipped (FUE). Returning to the Black Hawk paradigm, "officials note that 2,000 Black Hawks are already in use, and the program would make a good

pilot program for consolidating the military's helicopter training facilities."<sup>29</sup>

With the many tough decisions recently made resulting in numerous base realignments and closings we can no longer afford not to consolidate helicopter training and save significant base operating expenses. Consolidation has long been debated and might have been implemented earlier, if not for political considerations. If savings and efficiencies are truly sought that can make dollars available to procure the JTR, this is one way to obtain them, however the Services must prepare to take the political heat.

Equally important to gaining efficiencies with the JTR is the use of a common simulator whose software would be rapidly tailorable for specific Service mission profiles. All Services would have the same devices with different software packages available for different type missions. The simulators designed to be both air and sea transportable, could be placed aboard either mode of transportation allowing mission rehearsals to take place enroute to the conflict or area of operation. With the expected completion of a global data base in the very near future, simulators with the global data base could be integrated with real time intelligence and imagery gathering sources producing a constant update and rehearsal capability while enroute. This will greatly enhance the JTR's mission

effectiveness and safety which will save lives, reduce pilot stress and greatly reduce accidents.

To ease the transition to a common training base while maintaining the flavor of jointness across all Services, command of the common JTR training base would be alternated between the Services. Also instituting an all Service JTR instructor staff, would further accelerate the transition to jointness. As was demonstrated in the deployment of the 10th Mountain Division to Haiti, the ability to operate jointly and knowing more about each others Service has taken on new dimensions. This trend can only continue to expand in importance as each of the Services grow smaller and more dependent for support on one another in times of conflict.

Still, further economies can be achieved in the manning of the JTR. If one standard cargo helicopter is employed across all Services, greater flexibility and versatility for both pilot and maintenance resourcing in times of national emergency or war can be realized. Pilots and maintenance personnel qualified on the one cargo helicopter could be drawn from a pool of volunteers, the Individual Ready Reserves or if so equipped, from entire JTR unit replacements. Personnel resources could be rapidly cross leveled into or across all Services. With a much smaller active component the ability to accomplish this will provide greater ease of replacement or plus up in times of conflict

or national emergency. It won't matter what Service the pilot or maintenance replacements are placed as they will be flying or maintaining the same cargo helicopter, flying cargo missions. This is somewhat simplistic, but it can work given rotating annual training tours that will expose the pilots and maintenance personnel to all Services. With the capabilities now inherent in both helicopter flight simulators to rapidly expose and train pilots in different scenarios and situations as well as ground trainers for the maintenance personnel, the old argument of habitual association with a particular Service or unit simply isn't as strong as it was in the past, especially for the cargo mission.

#### CONCLUSION

Relying on the combined strengths of all the Services will carry our forces only so far into the future. As our cargo fleets continue to age, so too will their capabilities continue to decline. Prudent investment decisions between readiness and modernization must be made in the very near future so that the dollars required to recapitalize the aged and obsoleting fleets of cargo transporters are properly identified or our ability to exploit Force XXI technological innovations will be severely limited. The aged status of our cargo fleets can no longer be ignored for in the future, more than ever before, we will depend on the speed, agility

and dependability of the cargo helicopter transportation fleet. As Clausewitz wrote, "No engagement is decided in a single moment, although in each there are crucial moments which are primarily responsible for the outcome. Losing an engagement is , therefore, like the gradual sinking of a scale."<sup>30</sup> The scale is now sinking for the cargo helicopter fleets across all Services. We have reached a crucial moment; the time has come to halt the sinking scale.

Although the JTR is but one small part of a very complex logistical and transportation equation, it holds great promise in terms of meeting future force requirements, gaining efficiencies for all Services and in furthering jointness. Properly structured, the program can take advantage of over 50 years of platform technology by leveraging off previous programs and ongoing research and development.

Given the JTR's tremendous potential and the challenges that await the future smaller force, expeditious development and procurement of the JTR is mandated, as it will contribute significantly to accomplishing a most difficult and complex intra-theater transportation mission of the future.

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**END NOTES**

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