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Acceleration of Defense Technology Mastery: R-Han 122 B Rocket for the Establishment of National Defense Industry Independence in Supporting the Fulfillment of Defense and Security Equipment

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Abstract

The dynamics of the strategic environment always influence the procurement of the Main Weapon System Tool. These dynamics are felt when the need for weapons and combat technology is still very dependent on other countries, causing vulnerabilities in modernizing weapons. One of the efforts to develop rocket technology independently, although not yet fully, especially regarding some imported rocket raw materials, the Indonesian Defense Industry conducted a research program on the development of the R-Han 122 B Rocket which was worked on by the National Rocket Consortium with the Research and Development Agency of the Ministry of Defense. From several trials and dynamic tests that have been carried out, it is necessary to accelerate mastery of technology in order to perfect the resulting product. For this reason, it is necessary to prepare investments to complete the production line facilities and infrastructure, cooperation between industry and users, government policies and the government's alignment with investment in order to increase local content in meeting the needs of domestic and foreign consumers.

Keywords: *Mastery Acceleration; Technology Mastery; R-Han 122 B Rocket; Defense Industry Independence*

Preliminary

The dynamics of the strategic environment, both global and regional, always influence political, economic, social and military conditions. In the context of the procurement of the military equipment, this dynamic is felt when the need for weapons and combat technology is still very dependent on other countries, causing vulnerabilities in modernizing weapons. This indirectly means that Indonesia's defense forces will be known by the producing countries, where the knowledge and characteristics of the alusista technology will be stored in the producing countries. In addition, under certain conditions, restrictions, embargoes and even prohibitions may apply for the buying country to use the defense equipment purchased from abroad. This can have implications for the ability of the Indonesian Armed Forces military equipment as a means of defense.

Efforts towards the independence of the defense industry in supporting the fulfillment of Defense and Security Equipment Tools can be started by encouraging the active involvement of all domestic Defense Industry players, to accelerate mastery in terms of Defense Industry technology, which is supported by policies and synergy between state-owned enterprises. State-Owned Enterprises and Private-Owned Enterprises towards the independence of the Defense Industry (Setiadiono Rianto 2017). In order to fulfill Defense and security Equipment Tools, it is based on three basic policies for the fulfillment of Austsista by the Defense Industry which was conveyed by the President of the Republic of Indonesia at a Limited Cabinet Meeting in 2011(A. Tomy Trinugroho. 2011) is :

a. Mandatory to buy defense equipment produced by the domestic defense industry.

b. If you can't produce it yourself, the defense equipment system is purchased from another country on condition that certain conditions are not followed, especially those related to politics.

c. If it is not yet able to produce the desired defense equipment, Indonesia needs to build cooperation with other countries so that in time Indonesia will be able to build the defense equipment.

Of the three basic policy points for the fulfillment of the military equipment by the Defense Industry, it is an effort towards the independence of defense technology in overcoming problems in the production of defense equipment in the national Defense Industry. This is still not fully implemented in the supply of raw materials and the fulfillment of defense equipment that is still imported from abroad, but this is an effort to minimize the use of imported goods in order to achieve the goal of creating the independence of the national defense industry and is the key to accelerating mastery of technology. defense in the defense industry.

Mastery of technology is a challenge for the National Defense Industry to be able to compete with products from other countries. The 2015 Ministry of Defense White Paper stated in Chapter V point 1 that the development of the defense industry is a series of activities towards mastering technology to support the realization of a strong, deterrent, modern, and dynamic national defense system. The basis for assessing the capability of a defense industry can be seen in the level of technological and manufacturing readiness. This defines the industry's ability to make product changes as well as the application of tests and tests of components, sub systems, prototypes and complete systems to determine the essential functions of these products. This is reinforced by Permenristekdikti number 42/2016 concerning the regulation of Technology Rediness Levels (TRL) which is the level of maturity or readiness of a particular technology research and development result which is measured systematically divided into a scale of 1 to 9. Meanwhile, according to (Mankins 1995) in his article entitled "Technolgy Readiness Levels - A White Paper" which states that the Technology Readiness Level (TRL) is a systematic metric/measurement system that supports the assessment of the maturity of a particular technology and a consistent comparison of maturity between various types of technology..

In developing a technology, as stated in the article entitled "Manufacturing Readiness Levels (MRL) Deskbook" by (OSD Manufacturing Technology Program 2007), the measurement of Manufacturing Readiness Levels (MRL) cannot be separated from the measurement of Technology Readiness Levels (TRL). The article also includes the definition of MRL, which is creating a measurement scale to assess manufacturing maturity and risk regarding a structured manufacturing readiness assessment from evaluation of technology, components, manufacturing processes and systems. This case do for:

a. Determining the level of manufacturing maturity in an industry
b. identify deficiencies and risks related to costs and maturities during the production process.
c. Provides the basis for manufacturing maturation and risk management in an industry.

MRL is one of the tools used to measure the readiness of manufacturing maturity in producing research results. This tool also mitigates the risk and continuity of the research production process to mass production. In general, there are nine criteria in the MRL which include technology and industrial needs,

industrial product design, adequacy of financing and funding, availability of raw materials, production process capability and control, product quality management, technical and production workforce, manufacturing facilities and manufacturing management. The adequacy of meeting these criteria is described in the 10 MRL level to measure the achievement of translation from research results to the industrialization process.

The development of a defense product, adapted to the possibility of threats from the development of the strategic environment that occurs. For this reason, the user, in this case the Indonesian Armed Forces, can determine the detailed specifications needed from the Defense and Security Equipment Tools needed. From the detailed specifications desired by the user, the research and development process of Defense and security Equipment Tools can be carried out by existing R&D agencies. The R&D process in processing a prototype does not have to start from scratch, in this case the prototype to be developed can be the result of a product license from a country so that it can reduce research and development time carried out (Wibowo 2016).

Rockets as weapons are a basic provision to support Indonesian Armed Forces operational tasks in the field. One of the equipment owned by the Indonesian Navy Marine Corps Artillery in carrying out its main tasks is the RM-70 Grad Rocket launcher made in Czechoslovakia. In meeting the needs of RM-70 Grad rocket munitions, up to now, it is still done by means of procurement from abroad, where the capabilities of domestic industries such as Pindad Limited Company has not been able to support the need for rocket munitions, so it still has a very large dependence on producers from abroad which has a very influential effect on the readiness of the Indonesian Navy artillery troops, especially in carrying out their main tasks. For this reason, in meeting the need for Defense equipment so that it does not depend on other countries, the domestic industry must be able to produce rocket munitions, especially rocket munitions for the RM-70 Grad made in Czechoslovakia..

One of the efforts to develop rocket technology independently, although not yet fully, especially concerns some of the raw materials for rockets which are still imported. The Indonesian Defense Industry conducts a research program on the development of the R-Han 122 B Rocket which is being worked on by the National Rocket Consortium with the Research and Development Agency of the Ministry of Defense. If the rocket developed from the product purchased from Czechoslovakia has been mass produced, it will become the main weapon in the RM-70 GRAD Marine Armament Multiple Launcher Rocket System (MLRS), to supply the needs of the Marine Corps Field Artillery.

Acceleration of mastery of national Defense Industry technology, which can be achieved through appropriate efforts, in order to realize the provision of defense and security systems, namely by optimizing infrastructure and manufacturing facilities for the National Defense Industry. This adapts to technological developments both globally and regionally which continue to grow significantly through analysis of factors that affect the acceleration of technology mastery in the development of the R-Han 122 B.

Research Methods

The research method used is research with a qualitative approach. The type of research approach used in this research is descriptive analysis research which aims to describe or explain what is obtained based on the existing circumstances (Jhon Williaw Creswell 1994). The research design in this study uses grounded theory analysis, which is research that is directed at discovering or at least strengthening a theory. The basic theory approach is a qualitative research method that uses a systematic procedure to develop theory inductively which derives the basic theory. (Strauss and Corbin 2003). Basic theoretical research is carried out using various data collection techniques, checks and checks in the field, comparative studies between categories, to verification to the point of saturation (Strauss and Corbin 2003). The qualitative method used in this research is to get an overview of the program being

implemented, namely the development of the R-Han 122 B rocket which is focused on accelerating the mastery of technology.

The research locations in collecting the necessary data are R&D agencies ministry of defense, directorate of defense industry technology directorate general of defense potential of the ministry of defense, Pindad Limited Company, Indonesian Aerospace Limited Company, National Aviation And Space Agency, and Dahana Limited Company. The researcher took the place to carry out a field survey to find information about the factors that influence the acceleration of mastery of Defense Industry technology in the R-Han 122 B rocket development program.

Data collection techniques were carried out through interviews and using supporting data (documentation). The data obtained were then processed through data reduction, data presentation, and conclusion drawing. The entire data obtained is then checked for the validity of the data using the data triangulation method.

Research Results and Discussion

The R-Han 122 rocket is a rocket product used for defense purposes developed by the Ministry of Defense. The idea to produce rockets domestically began in 2004, related to this the Ministry of Research and Technology at that time formed a D-230 team to develop a research on making rockets with a range of 20 Km which was funded by the Ministry of Defense in collaboration with Pindad Limited Company in fulfilling the 1000 rocket program.

The development of the R-Han 122 defense rocket began with the involvement of the Research and Development Agency of the Ministry of Defense with the Ministry of Research and Technology, Pindad Limited Company, National Aviation And Space Agency (Now the National Research and Innovation Agency), Universities and other related parties. In 2011, the development of the R-Han 122 B rocket was started, which is a refinement of the R-Han 122 A, with the addition of the length of the rocket tube from 1 meter to 2 meters which will later be used as multi-barreled rocket artillery munitions or the Multi Launcher Rocket System (MLRS). RM-70 GRAD Marines made in Czechoslovakia to supply munitions for the Marine Corps Field Artillery. This is done as one of the efforts to develop rockets independently, although it has not been fully implemented in terms of independence, especially regarding some of the raw materials for rockets that are still imported.

The R-Han 122 B rocket made by members of the National Rocket Consortium consists of several main component products such as 1) Fuze, 2) Warhead, 3) Igniter, 4) Structure / Tube (sleeve containing propellant), 5) Propellant, 6) Nozzle, and 7) Ruptured Disk. The scope of work on the development of the R-Han 122B Rocket which is handled by the National Rocket Consortium is shown in Figure 1. below.

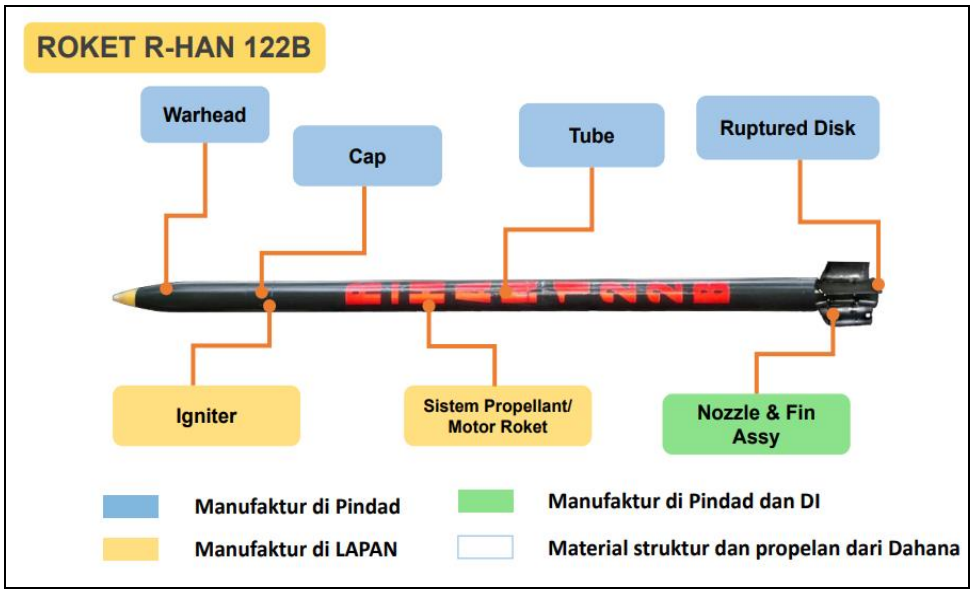

Figure 1. Division Scope of Work (SOW) R-Han 122 B. Rocket Consortium
Source: Seminar on the R-Han 122 B Rocket development program in Bandung, June 28th2019

Acceleration of Mastery of R-Han 122 B Rocket Technology

In the development of the R-Han 122 B rocket, Indonesian Aerospace Limited Company is responsible as Lead Integrator in 2017, and manufactures Nozzle and Fin Assembly components. Pindad Limited Company in the 2017 fiscal year was assigned to make Warhead Production, Motor Tube Production, Rupture Disk Production and Launch System. Dahana Limited Company in the 2017 fiscal year is responsible for making Propellant and Igniter Production. Procurement of Raw Material Production, and Static/Lab Tests supported by National Aviation And Space Agency, as well as providing rocket raw materials. National Aviation And Space Agency is responsible for formulating and manufacturing propellants and Assembly Igniter. In addition, National Aviation And Space Agency is also tasked with conducting static tests of rocket motors, Drop Tests, Igniters and propellant tests.

a. R-Han Development Program 122 B 2017

The components produced by the National Rocket Consortium are integrated into two groups, namely the integration of the rocket motor and the integration of the overall components, which are carried out at Indonesian Aerospace Limited Company. The integrated rocket motor is then subjected to drop tests, hydrostatic tests, and static tests. Furthermore, the integrated rocket is tested dynamically, including its ability to achieve the target that has been set.

R-Han 122 B rockets produced and tested in 2017 amounted to 77 units in accordance with contract No. TRAK/89/II/2017 dated February 21, 2017 concerning the Procurement of the Shooting Table Compilation Program and Product Certification of R-Han 122 B FY 2017 Phase I. The dynamic test results indicate an indication of track failure caused by the failure of the nozzle and fin assy construction structures resulting in unstable rocket speed which causes the trajectory to be inconsistently straight.

To fix the problems caused during the launch experiment, as an effort to accelerate the mastery of defense industry technology, a new design for the nozzle and fin assy was made, taking into account the fin locking system and material changes as shown in Figure 2. Below :

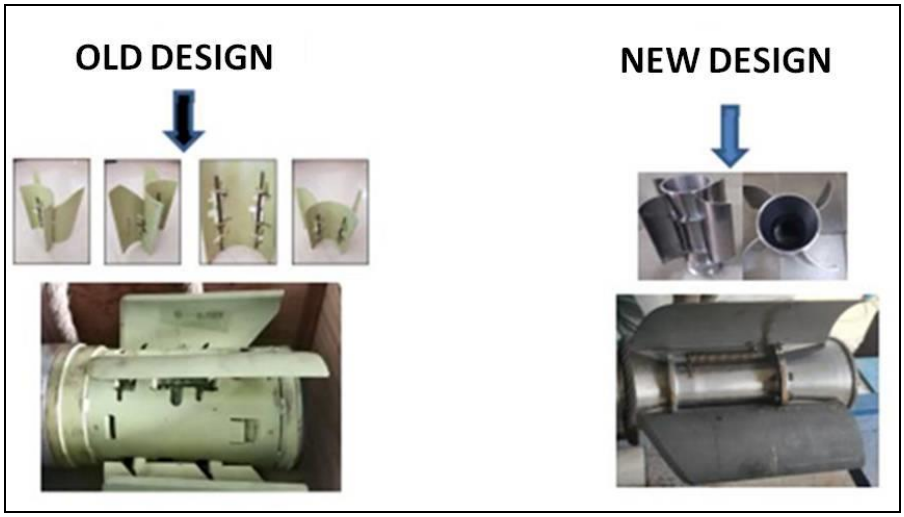

Figure 2. Image Nozzle dan Fin Assy
Source: Final Report Program Preparation of firing tables and product certification of R-Han 122 B rockets

In the old design image, it is bent by aluminum using a less rigid spring so that when sliding it still experiences vibrations in the fin which is only supported by the strength of the spring on the fin. So that the vibrations cause inconsistencies in the trajectory movement when the rocket is gliding which causes a shift. the location of the desired target. Meanwhile, in the new design on the R-Han 122 B fin, which is designed from metal as a whole, with a more rigid spring when it opens, it immediately locks the fin position by 2 pens on the rocket. The system used is from Avibras by adopting a locking system on the part of the rocket. This is one proof that Transfer of Technology is very much needed in the context of mastering technology in the National Defense Industry.

b. R-Han Development Program 122 B 2018

The R-Han 122 B rockets produced and tested in 2018 amounted to 60 units according to contract No. TRAK/77/IX/2018/DJPOT dated September 10, 2018 concerning the Procurement of the Shooting Table Compilation Program and Product Certification of R-Han 122 B. The results of the propellant validity test on 1 rocket unit, drop test on 1 rocket unit, hydrostatic test on 1 rocket unit and static test on 2 rocket units showed good results. While the dynamic test showed that the results were quite good, carried out on November 27, 2018. Although the results of this test were still temporary, the flight stability of the R-Han 122 B rocket munitions was obtained after improvements to the nozzle and fin assy construction. However, the results of the tests carried out during the rocket launch still produce a lot of smoke, so this is a new challenge for the consortium in accelerating the mastery of defense industry technology. Related to this, the R-Han 122 B rocket propellant material must be tactically and technically safe for the user, especially the smoke effect it causes. In addition to being tactical, it will be easy for the enemy to know the position of the rocket launch when used in warfare as well as from the effects of smoke, technically, it causes residue on the barrel of the launcher tube.

c. Advanced R-Han 122 B rocket development program

In determining and making a firing table using 120 rocket units it is still lacking, related to this it is required in 1 elevation more than 100 rocket units are used. For this reason, it is programmed to fire 1000 rockets with the aim of perfecting the firing table to be made. However, this is constrained by the

propellant production process handled by Dahana Limited Company with National Aviation And Space Agency by using existing production facilities in the laboratory of the National Research And Innovation Agency Rocket Research Center. So the ability to produce propellant production is still very limited, which is approximately to support 200 to 250 rockets per year because the facilities used are not industrial scale but lab scale.

In an effort to overcome the limitations of propellant production as a step to accelerate the mastery of defense industry technology, Dahana Limited Company and National Research And Innovation Agency collaborated on technology transfer to implement a system that could produce large amounts of propellant. The propellant production system located at National Aviation And Space Agency actually already has a production line, in this case National Aviation And Space Agency itself has carried out a technology mastery test up to level 7 from the results of an audit conducted by Agency for the Assessment and Application of Technology. The planning of the cooperation which is still being discussed is Dahana Limited Company will invest in propellant production equipment such as lining equipment and mixers with a capacity of 600 liters to complete the shortage of 2 mixer machines in National Aviation And Space Agency with a capacity of 100 liters per unit. This is done with the hope of achieving the production of propellant intended for 500 rocket units.

The technical implementer of the R-Han 122 B rocket certification until November 2018 has submitted a letter of recommendation and has carried out a Kick of Meeting which was attended by the consortium and the airworthiness center of the Ministry of Defense. The certification process has been completed with the output in the form of certification of the R-Han 122 B rocket military air weapon type in the Artillery Ground to Ground Rocket Air Weapon category with the number: IMMA TC AW/Roket 001-2019. For this reason, it is necessary to test Mass Production Proof and test the consistency of rockets both with single and salvo shots with the rocket requirements for the test as many as 804 grains.

Conclusions and Recommendations

Based on the analysis and discussion in this study, it can be concluded how the acceleration that has been carried out by the national rocket consortium in mastering technology on the R-Han 122 B rocket is proven by making changes to the nozzle design and fin assy. This shows that the Transfer of Technology conducted with Avibras is a form of international cooperation in achieving mastery of technology. The scale of technological mastery from the national rocket consortium in this case the Technological Readiness Level or TRL has evenly reached level 7. However, industrial manufacturing readiness is still uneven, especially for propellant production which is still on a lab scale, so it cannot fulfill the 1000 rocket program per year.
For this reason, it is recommended that:

a. Industry and user collaboration must be integrated to obtain product improvements used in order to achieve modernization in improving performance and consistency of desired product accuracy where in the end it is the user who will use the product.
b. Government policy must be committed in this case the State Capital Participation in the kitchen set up of the propellant production line or rocket booster so that it is consistent in order to achieve one production that meets the requirements of one mass production.
c. The government's alignments must be able to invest to complete the production line facilities and infrastructure with the hope that if this is achieved, in addition to being able to meet the needs of the Indonesian Armed Forces, it can also export in the development of the nation's economy in meeting the needs of domestic and foreign consumers, so that this can be used as a concept that must be known by the government in achieving independence in domestic production.

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