

Study Of The Formation Of Aircraft Military Rescue And Fire Fighting Units At Tni-Al Juanda Air Base Surabaya

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Abstract— ARFF (Aircraft Rescue and Fire Fighting) is one of the main and critical components in responding to emergencies in the world of aviation. Every civil airport is required to have ARFF services, while military bases/air bases have their own ARFF with specific tasks and training. According to ICAO Doc. 9137 the main task of the ARFF is to save lives (aircraft passengers, aircraft crew and all people on board the aircraft that had an accident) and property (aircraft, airport facilities, etc.). TNI-AL Juanda Surabaya Air Base as the Indonesian Navy Aviation Center (PUSPENERBAL) in serving military flights does not yet have a Rescue and Fire Fighting unit that functions to provide rescue and fire fighting services in the event of a military aircraft accident. Based on this background, the formulation of the problem in this study is that forming an ARFF unit is carried out in accordance with applicable regulations using qualitative research methods with interview, observation and documentation data collection methods. Based on the results of the research, to form an Aircraft Military Rescue & Fire Fighting Unit at the Juanda TNI-AL Surabaya Base, a category for ARFF is needed, namely Category 4 (four) based on the dimensions of the largest TNI-AL aircraft operating at the TNI-AL Juanda Air Base, Surabaya.

Keywords— ARFF, Air Base, Aviation Safety, Flight Operations, Aircraft.

I. INTRODUCTION

ARFF (Aircraft Rescue and Fire Fighting) is one of the main and critical components in emergency management in the aviation world. Every civil airport is required to have ARFF services while for military bases / air bases have their own ARFF with special tasks and training.

In accordance with ICAO Doc. 9137 the main task of ARFF is to save lives (aircraft passengers, crew and all persons on board the aircraft that have been involved in the accident) as well as property (aircraft, airport facilities etc.).

ARFF must meet the response time, namely the ARFF reaction time from the start of the aircraft having an accident or the first time the crash bell is sounded to emit the main extinguishing agent as much as 50% of the average beam of the Airport category for 2 minutes and must not exceed 3 minutes.

Response Time must be achieved by ARFF personnel to provide maximum service in emergency response. The application of Response Time standards has been regulated in Aviation Standards and Regulations both nationally and internationally.

ARFF is obliged to provide emergency response services for aircraft that experience an accident within a radius of 8 Nm or 5 Km from the airport reference point.

The TNI-AL Juanda Air Base Surabaya was originally built as the main base for Navy aviation, in its development it was used jointly by PT. Angkasa Pura I is used as an international airport that serves civil flights of commercial aircraft on domestic and international routes. In peaceful conditions, the existence of Juanda International Airport applies a civil enclave (in a civil enclave) and its management applies civil regulations.

Meanwhile, in martial law or war conditions, it will turn into a military enclave (in military enclaves), so that the bandra management flexibility applies to military regulations and laws along with other military interests.

Juanda Air Base Surabaya as the Indonesian Navy Aviation Center (PUSPENERBAL) in serving military flights does not yet have a Rescue and Fire Fighting unit that functions to provide rescue and fire fighting services in the event of a military aircraft accident. So, when there is a military plane accident that carries out rescue and extinguishing is from the Airport Rescue and Fire Fighting (ARFF) unit of Juanda International Airport Surabaya which based on its function is specifically for civil aviation.

When this happens, problems arise including the following:

1. The handling of military aircraft accidents is likened to that of civilian aircraft.
2. Risk of procedural errors during military aircraft blackouts
3. Risk assessments carried out on military aircraft are inappropriate.
4. The potential for casualties from ARFF personnel of Surabaya Juanda International Airport resulting from the explosion of military aircraft weapons systems.
5. ARFF personnel of Juanda International Airport Surabaya hesitated in carrying out the operation.
6. The process of evacuating victims was constrained when it had to carry out the extrication process on military aircraft.

The unavailability of military ARFF units at Juanda Air Base Surabaya will be an obstacle in the process of emergency management of military aircraft which of course characteristic, structure and dangerous goods on military aircraft are different from civil aviation aircraft.

II. LITERATURE REVIEW

1. Aircraft Rescue and Fire Fighting

This theory review contains the source of the theory which will then be the basis of writing. The source of the theory will later become a framework or basis for understanding the background of a problem systematically. In this theoretical review, the author will explain the basic scope of work of the Aviation and Fire Fighting Accident Relief unit (which will later be abbreviated as ARFF) and its role both inside the airport and around (outside) the airport area.

One of the aviation security units is ARFF [1]. It is stated in ICAO doc. 9732, Annex 14 Aerodromes 1999 that an Aircraft Rescue And Fire Fighting unit is a work unit that must be at every airport. In the aviation rules in our country, namely KP 14 of 2015 in article 1 contains that "Every airport operator unit and airport business entity must provide and provide Aircraft Rescue and Fire Fighting (ARFF) services in accordance with technical and operational standards for Aircraft Rescue And Fire Fighting (ARFF) services and airport categories for Aircraft Rescue And Fire Fighting (ARFF). ARFF itself is a unit part of emergency management [2].

ARFF units are required to provide services in accordance with the relevant airport category. ARFF services themselves are carried out quickly and precisely for rescue and Aircraft Rescue And Fire Fighting as well as fire fighting at airports and surrounding areas. Every service provided must also be in accordance with the standard tasks and functions of the ARFF unit itself. With the implementation of ARFF services optimally, it is one of the main drivers of the formation of maximum aviation transportation security as well.

It is clearly stated in PR 30 of 2022 that the duties and functions of the ARFF unit at the airport [3], namely:

- a. Provide ARFF services to save the lives and property of an aircraft that experiences an incident or accident at the airport and its surroundings, and
- b. Prevent, control, extinguish fires, protect people and property threatened by fire hazards in facilities at airports.

As in the number one task and function is a top priority in providing ARFF services at each related airport. This is also explained in KP 14 Year 2015 in the next chapter

2. Airport Categories for ARFF

Every airport must provide facilities ARFF according to airport category for ARFF required. Airport categories for ARFF consists of 10 (ten) category levels. Determination of the airport category itself using data on the length and width of aircraft operating at the airport with the largest aircraft movements using airports of no less than 700 busiest movements in three consecutive months.

ARFF units are classified into four types, including:

- a. ARFF unit type A for airport category 8 to 10
- b. ARFF type B units for airport categories 6 and 7
- c. Type C ARFF units for airport categories 4 and 5, and
- d. Type D ARFF units for airport categories 1 to 3.

3. Extinguishing Agent Requirements

Each airport must be equipped with fire extinguishers according to the airport category for ARFF, in the form of main fire extinguishers and complementary fire extinguishers. The main fire extinguishers used for ARFF, among others:

- a. Water
- b. Quality A foam
- c. Quality B foam
- d. Quality foam C
- e. Foam Combination

While the complementary fire extinguishers used for ARFF, among others:

- a. Carbon dioxide (CO₂)
- b. Multipurpose type Dry Chemical Powder is suitable for the extinguishing of hydrocarbon fire materials.

4. ARFF personnel

Each airport must provide ARFF unit personnel who have the licenses required by the Directorate General of Civil Aviation in accordance with the category of each airport for ARFF and must maintain their competence, license and health.

The competence of ARFF personnel as regulated in the Minister of Transportation Regulation Number PM 37 of 2021 concerning Airport Personnel, namely the level of competence of ARFF personnel consists of Basic ARFF, Junior ARFF and Senior ARFF [4]. To obtain these competencies, each ARFF personnel is required to attend education and training in

accordance with the level of each competency at a training institution that has been certified by the Ministry of Transportation.

5. ARFF vehicles

Each airport must provide ARFF vehicles whose number and type are adjusted to the amount of fire extinguishers required in the airport category for ARFF.

6. ARFF Operational Support Equipment

Every major vehicle ARFF Must be equipped with operation support equipment ARFF according to airport category for ARFF.

III. RESEARCH METHOD

The approach used in this study is a qualitative approach. A qualitative approach is a research procedure that produces descriptive data in the form of written or spoken words of people and observable behavior. The qualitative approach has natural characteristics (Natural setting) as a source of direct, descriptive data, process is more important than results. Analysis in qualitative research tends to be carried out by inductive analysis and meaning is essential. (Lexy Moleong, 2006: 04). The qualitative approach according to Kriek and Miller in Moleong's book explains that the qualitative approach is a certain tradition in social science that relies on human observation in its area and relates to these people in their language and terminology.

The object in qualitative research is a natural object, or natural setting, so this research is often called naturalistic research. Natural objects are objects that are as they are, are not manipulated by researchers so that the conditions when researchers enter the object, after being in the object and exit the object are relatively unchanged. In qualitative research the researcher becomes an instrument. Therefore, in qualitative research, the instrument is a person or Human instrument. To become an instrument, researchers must have a broad theoretical and insightful provision, so as to be able to ask, analyze, photograph and construct the object under study to be clear and fed. The criteria for data in qualitative research are definite data. Definite data is data that actually occurs as it is, not data that is just seen, spoken, but data that contains the meaning behind what is seen and spoken [5].

IV. ANALYSIS AND DISCUSSION

1.1 ANALYSIS

The first step needed to carry out the analysis in this study is the determination of the airport category for ARFF. The determination of this category is regulated in international regulations in ICAO Documents, namely Annex 14 Vol. I Aerodrome and Doc. ICAO 9137 Part I Airport Rescue and Fire Fighting and regulated in national regulations, namely referring to the regulations of the Decree of the Director General of Civil Aviation Number PR 30 of 2022 concerning Technical Standards and Civil Aviation Operations Part 139 (Manual Of Standard CASR 139) Volume IV Aviation Accident Relief and Fire Fighting Service (PKP-PK) [6].

a. ARRF Category Analysis Juanda Air Base Surabaya

The determination of airport categories for ARFF is analyzed based on the overall length and maximum width of the largest airframe operating at the airport taking into account the amount of movement.

b. Analysis of Theoretical Critical Area (AT) and Practical Critical Area (Ap)

Concept Theoretical Critical Area (AT) and Practical Critical Area (AP) is a concept used to calculate how large a critical area will experience the impact of a widespread fire on the aircraft that experience accident which is accompanied by fire. Theoretical Critical Area (AT) is the calculation of the area of the critical area in full while Practical Critical Area (AP) The calculation of the area of critical areas with the area of fire has been influenced by surrounding environmental factors such as wind speed, wind direction, air humidity, temperature, weather and so on. So the calculation of area Practical Critical Area (AP) is only 2/3 (two-thirds) or 0.667 of the area Theoretical Critical Area (AT). Theoretical Critical Area (AT) and Practical Critical Area (AP) is the basis for calculating the minimum level of water requirements to produce extinguishing foam (fire foam) as the main extinguishing agent on ARFF. Here is an illustrative image for the area Theoretical Critical Area (AT) and Practical Critical Area (AP) :

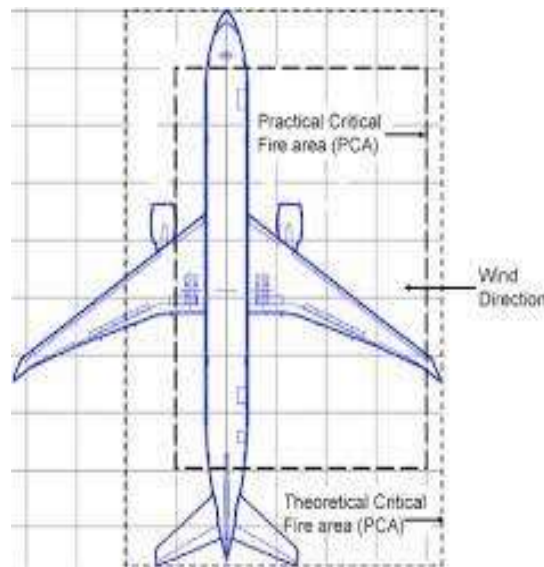


Figure 1. Theoretical Critical Area (AT) and Practical Critical Area (Ap)

c. Analysis of Total Water Requirements (Q) to produce foam (foam)

Each airport is required to provide the amount of extinguishing material according to the level of the airport category for ARFF, both main extinguishers and complementary extinguishers. The main extinguishing agent that must be prepared is water extinguishing agent, because water in addition to being the main extinguishing agent is also a material for producing other main extinguishing agents, namely foam extinguishing agents (foam).

Foam is produced from a mixture of water with foam concentrate in accordance with the required foam quality. The need for water extinguishers has been determined based on the airport category level for ARFF obtained on the basis of the calculation of the concepts of Theoretical Critical Area (AT) and Practical Critical Area (Ap) of each type of aircraft.

Based on data from military aircraft operating at the TNI-AL Juanda Air Base Surabaya, the need for water extinguishers for each of these aircraft will be analyzed. The calculation of the water extinguisher needs of each type of aircraft will use Theoretical Critical Area (AT) and Practical Critical Area (Ap) data for each aircraft that has been analyzed in the discussion of Theoretical Critical Area (AT) and Practical Critical Area (Ap) analysis above.

1.2 DISCUSSION

1. ARFF Category Determination of TNI-AL Juanda Air Base Surabaya

Based on the results of the analysis that has been carried out on the data obtained at the TNI-AL Juanda Air Base Surabaya in the form of:

- a. Type of aircraft in operation;
- b. Fuselage length;
- c. Fuselage width;
- d. Theoretical Critical Area (AT);
- e. Practical Critical Area (AP);
- f. Q1 and Q2.

In determining the type of category for ARFF at an airport or air base, it is determined based on the largest type of category on aircraft operating at an airport or air base. So it can be concluded that the ARFF category at the TNI-AL Juanda Air Base Surabaya is Category 4.

2. Determination of Extinguishing Agent Requirements

Once the category is known ARFF at the Juanda TNI-AL Air Base Surabaya, this category is a reference to prepare all aviation accident relief and fire fighting service facilities at the Juanda TNI-AL Air Base Surabaya to save lives and property when they occur incident and accident.

One of the main facilities that must be prepared is extinguishing materials, both main extinguishing agents and complementary extinguishing agents. The determination of this extinguishing agent is based on calculations Theoretical Critical Area (AT) and Practical Critical Area (AP). In the Decree of the Director General of Civil Aviation Number: PR 30 of 2022 concerning Technical and Operating Standards of Civil Aviation Safety Regulations Part 139 (Manual of Standard CASR Part 139) Volume IV of the Aviation Accident Relief and Fire Fighting Service stipulates the maximum standard of extinguishing agents that must be provided based on the largest aircraft size as follows:

- a. Water Extinguishing Agent uses B quality foam with an application rate of 5.5 L / min / m² for ARFF at the TNI-AL Juanda Air Base Surabaya must prepare a maximum of 2,921.30 liters of water when using Quality B Foam.
- b. Water Extinguishing Agent Using C quality foam with an application rate of 3.75 L/min/m² for ARFF at the TNI-AL Juanda Air Base Surabaya must prepare a maximum of 1,991.80 liters of water when using Quality C Foam 3
- c. Extinguishing Agent Foam

Capacity Foam provided in Foam Tender separately to produce foam, it must be adjusted to the water capacity and type Foam selected in Foam Tender. Capacity Foam available at Foam Tender must be sufficient to produce foam at least 2 (two) times operation ARFF or at least 12% of the water capacity Foam Tender.

By category ARFF at the TNI-AL Juanda Air Base Surabaya is category 4 so that according to the calculation of water extinguisher needs, at least 1 unit of vehicle is needed Foam Tender Type V. Calculation of extinguishing agent requirements Foam as follows:

$$\begin{aligned}\text{Necessity Foam} &= 12 \% \times \text{Water Tank Capacity Foam Tender Type V} \\ &= 12 \% \times 2,400 \text{ liters} \\ &= 288 \text{ liters}\end{aligned}$$

Amount of extinguishing agent foam concentrate that must be available in the tank Foam The vehicle is as large as 288 liters.

The TNI-AL Juanda Air Base Surabaya is category 4 so it needs backup foam concentrate as big as 288 liters. So that the total need for extinguishing materials foam concentrate What must be provided is :

$$\begin{aligned}\text{Foam Concentrate} &= \text{Foam Concentrate Home} + \text{Foam Concentrate Backup} \\ &= 288 \text{ liters} + 288 \text{ liters} \\ &= 576 \text{ liters}\end{aligned}$$

d. Complementary Extinguishing Agents

For ARFF at the TNI-AL Juanda Air Base Surabaya must prepare:

- 1) Minimum Water Extinguishing Agent for Quality B Foam is 2,400 liters;
- 2) Minimum Water Extinguishing Agent for Quality C Foam is 1,700 liters;
- 3) Minimum Dry Chemical Powder Complementary Extinguishing Agent is 135 kg.

3. Determination of Vehicle Needs ARFF

Once the category is known ARFF At the TNI-AL Juanda Air Base Surabaya, vehicle needs can be determined ARFF which should be provided taking into account things as follows:

- a. The amount of extinguishing agent required for category fulfillment;
- b. Availability of ARFF personnel;
- c. Hard-to-reach areas at air bases;
- d. Operational functions during rescue and blackout operations;
- e. Preventive Maintenance of ARFF equipment;
- f. Technological developments and/or operational needs of air bases.

The main vehicle needs for ARFF at the Juanda TNI-AL Air Base Surabaya is 1 Unit Vehicle Foam Tender Type V.

4. Determination of Personnel Needs ARFF

Once the category is known ARFF At the Juanda Air Base Surabaya, the need for the number of personnel can be determined ARFF and personnel competence ARFF that need to be owned.

a. Number of ARFF Personnel

The need for personnel to carry out ARFF operations is calculated based on the number of ARFF Vehicles available to meet the ARFF category. The minimum number of ARFF personnel at the TNI-AL Juanda Air Base Surabaya as category 4 can be calculated by the formula:

$$K_{pr} = (3FT + 2KP + 1WR) \times S$$

Information:

K_{Pr} = Personnel Needs ARFF for Operations

FT = Foam Tender

KP = Support Vehicle ARFF

WR = Watchroom

S = Shift Work

So that:

$$\begin{aligned} K_{Pr} &= (3 + 2 + 1) \times 1 \\ &= 6 \text{ people / shift} \end{aligned}$$

In 1 (one) shift, the number of ARFF personnel from the Juanda TNI-AL Base Surabaya needed for operations is 6 (six) people with the following details:

- 1) 3 personnel for foam tender vehicles;
- 2) 2 personnel for ambulance vehicles;
- 3) 1 personnel for the watch room

b. ARFF Personnel Competency

Every personnel ARFF Must have competence in order to provide aviation accident relief and fire fighting services. This competency is obtained by attending education and training ARFF at training institutions that have been certified by the Directorate General of Civil Aviation. Personnel competence ARFF Consists of 3 (three) types of competencies, namely:

- 1) Basic ARFF is obtained by participating in Basic ARFF Training;
- 2) Junior ARFF is obtained by attending Junior ARFF Training;
- 3) Senior ARFF is obtained by attending Senior ARFF Training.

This type of ARFF competency is tiered starting from the lowest is Basic ARFF to the highest is Senior ARFF.

Competency standards ARFF regulated in the Regulation of the Minister of Transportation of the Republic of Indonesia Number PM 37 of 2021 concerning Airport Personnel. In the competency standard, the authority to operate each type of main vehicle and supporting vehicle is determined based on the level of competence. Each of these competency standards is set for service operations ARFF at the airport.

Minimum personnel requirements ARFF Based on Competency Level adjust the category level ARFF. Minimum need for personnel competence ARFF TNI-AL Juanda Air Base Surabaya with category 4 in each shift, namely:

- 1) ARFF Senior Competencies : 1 person;
- 2) ARFF Junior Competence : 2 people;
- 3) Basic ARFF Competency : 3 persons.

5. Determination of ARFF Operational Equipment

Each category ARFF must provide operational equipment ARFF with quantities and specifications in accordance with the provisions, including:

- a. fieldwork clothes;
- b. Protective clothing;
- c. Respiratory equipment;
- d. Other ARFF operational equipment.

V. CONCLUSION

From the analysis and description above, the following conclusions can be drawn:

1. In the formation of the Aircraft Military Rescue & Fire Fighting Unit at the TNI-AL Juanda Base Surabaya, it began with the determination of the ARFF category based on the concept of:
 - a. Type of aircraft in operation;
 - b. Fuselage length;
 - c. Fuselage width;
 - d. Theoretical Critical Area (AT);
 - e. Practical Critical Area (AP);
 - f. Q1 and Q2.
2. To form an Aircraft Military Rescue & Fire Fighting Unit at the TNI-AL Juanda Base Surabaya, a category for ARFF is needed, namely Category 4 (four).
3. The largest aircraft operating at the TNI-AL Juanda Air Base Surabaya, namely CN 235-220 MPA Aircraft has a Theoretical Critical Area (AT) of 421.58 m² and a Practical Critical Area (Ap) of 281.19 m².
4. For the competence of ARFF personnel at the TNI-AL Juanda Base Surabaya is focused on military aircraft objects.

VI. ACKNOWLEDGMENT

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