AF3
Advanced Forest Fire Fighting

D7.2.2 – AAFF system specifications

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PP	Restricted to other programme participants (including the Commission Services)	☐
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REVISIONS LOG

REV	CHANGE REFERENCE	DATE	CHANGE DESCRIPTION	PREPARED
A		15/12/2014	First Issue/ All Pages	D. Gallardo
B		03/01/2015	CL 215/415 and helicopter are introduced	D. Gallardo
C		27/05/2015	Part C, Part D.	D.Gallardo
D		08/06/2015	Ethical Issues	Dana Remes

ABBREVIATIONS AND ACRONYMS

ABBREVIATION / ACRONYM	DESCRIPTION
AAFF	Advanced Aerial Fire Fighting
AC	Aircraft
AF3	Advanced Forest Fire Fighting
CHADS	Cargo Handling Aerial delivery System
C.G.	Centre of Gravity
EMI	Electromagnetical Interference
EMC	Electromagnetic Compatibility
HIRF	High Intensity Radiated Fields
KIAS	Indicated Airspeed (kts)
MAC	Mean Aerodynamic Chord

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1. SCOPE

In recent years, the frequency of large-scale forest fires has increased significantly owing to a number of factors including the effects of climate change, urbanization, poor landscape management and malevolent acts. These so-called “Mega-fires” are particularly destructive and difficult to control with the technologies and systems currently available to fire fighters and emergency agencies.

AF3 project is a collaborative program of the 7th Framework Programme oriented to the AAFF system development (ELBIT), its posterior installation on three different aerial platforms(C-295, CL-215/415, and helicopter chosen on D7.2.1) and the execution of a flight test campaign to demonstrate the new concept.

The AF3 project intends to provide an extraordinary improvement to the efficiency of current firefighting operations and to the protection of human lives, the environment and property by developing innovative technologies and means to ensure a high level of integration between existing and new systems.

The objective of the implementation of the novel AAFF (Advanced Aerial Fire Fighting) system is to accurately and safely disperse extinguishing materials from high altitude by aircrafts and helicopters in any condition: day and night, regardless of weather, smoke and configuration of terrain. It will enable a quick 24H response, minimizing fire duration and damages. The AAFF system can be adapted to a wide variety of aircrafts or helicopters.

The results of AF3 will be validated by intermediate tests during the project and by a final demonstration with flight tests and drilling exercises carried out in Spain, Italy, Greece and Israel.

This document is divided on four parts:

1. The first part (PART A) purpose is to establish a preliminary Top Level Design Requirement Document (TLDRD) for the integration of the AAFF system in to the C295 airframe, and to support the design and the installation of the AAFF within the C-295.

   Requirements presents in this part will be divided into two groups:

   a. Requirements applicable during flight test campaign
   b. Requirements applicable during the possible commercial use of the AAFF system

2. The second part (PART B) purpose is to summarize the compatibility analysis and adaptation of the AAFF system onto the CL215/415 and the helicopter chosen on D7.2.1
3. The third part (PART C) includes information about the logistics accessories and tools that will be developed on this project
4. The fourth part (PART D) includes the post mission debriefing and analysis tools that will be developed in order to provide the aircrew and the crisis management teams the capability to determine the efficiency of the firefighting missions and decide on ways forward.

2. REFERENCED DOCUMENTS

2.1 CONTRACTUAL DOCUMENTS

2.2 APPLICABLE DOCUMENTS

[1] C-295 Cargo Loading Manual

[2] C-295 Airplane Flight Manual

[3] C-295M Training Manual Aerial Delivery Course

[4] C-295 Technical data for AF3 project

[5] D 7.2.1. Helicopter AAFF survey Report

3. DEFINITIONS

SHALL	The word **SHALL** in the text denote mandatory capabilities that shall be embodied in the C295 or the AAFF system in order to satisfy the minimum performance requirements for mission effectiveness and suitability of the AF3 project. The C295 and the AAFF system **shall** meet all Minimum Performance Standards and departure from such a requirement is not permissible. Where the full minimum performance requirement is not provided, the threshold capability may be traded against other technical requirement and the proposed technical solution **shall** provide the supporting rationale including a summary of technical and non-technical trade studies.
WILL	The word **WILL** in the text denotes threshold capabilities that will be embodied in the C295 or the AAFF system in order to satisfy either the optional or the desirable requirements for mission effectiveness and suitability of the AF3 project. The C295 and the AAFF system **will** address each threshold requirement. Where the full threshold capability is not provided, the threshold capability may be traded against other technical requirement and the proposed technical solution shall provide supporting rationale including a summary of technical and non-technical trade studies.
WARNING	Remarks on operating procedures, limitations, techniques, etc., which may result in personnel injury or loss of life if not carefully observed

PART A: AAFF SYSTEM INTEGRATION ON C-295

1. GENERAL CRITERIA FOR AIRDROP LOADS

According to Ref [1]*"Any equipment or load of supplies designated for airdrop should be rigged in accordance with its approved, specific individual rigging manual, or other command-approved technical directives. Loads consisting of hazardous materials, such as fuel, ammunition, explosives, etc., must be packed and certified exactly the same as for logistic airlift. All dimensions, weights, centre of gravity, parachute size, line lengths, and load restraint shall be checked by an airdrop inspector of the transported unit and the crew loadmasters, to guarantee that airplane limits and capabilities are not exceeded."*

"WARNING: AIRDROP OPERATIONS MUST BE CONDUCTED IN SUCH A MANNER THAT NO DOUBT EXISTS ABOUT SAFETY. WHEN THE DIMENSIONS, WEIGHT, ETC., APPROACH OR REACH THE LIMITS OF THE AIRCRAFT, EVEN A MINOR MISRIGGING MAY CAUSE AIRPLANE DAMAGE OR JEOPARDIZE FLIGHT SAFETY. LOADS RIGGED IN SUCH A MANNER THAT MAY ENDANGER SAFETY IN FLIGHT, SHALL BE REJECTED BY THE LOADMASTERS."

2. GEOMETRY REQUIREMENTS

The AAFF system shall be installed inside the C295 cargo cabin. In consequence, the cargo cabin and ramp & rear door dimensions limit the geometry of the AAFF system.

These geometry requirements apply to flight test campaign and during the commercial use of the system.

2.1 CARGO CABIN DIMENSIONS

The cargo cabin dimensions are specified on Ref [4]

According to Ref[1], *"WARNING: DESPITE OF AIRPLANE DIMENSIONS, LIMITATIONS ESTABLISHED ON APPLICABLE REGULATIONS, REGARDING SAFETY AISLES, UNOBSTRUCTED EMERGENCY EXITS, AND SAFETY MARGINS MUST BE OBSERVED. THE AIRCREW MUST HAVE ACCESS TO THE AFT OF THE AIRPLANE IN ALL CASES"*

In consequence, and according to MIL-STD-1791, it is required one aisle 14'' width (355mm) enabling one person to pass along the cargo cabin and the cargo ramp.

C-295 cabin sections and the standard cross section are specified on Ref [4]

2.2 RAMP DIMENSIONS

The ramp dimensions are specified at Ref [4]

Next considerations shall be taken into account:

• When the ramp is fully open to ground level, it presents a variable slope depending on the aircraft gross weight and position of its centre of gravity. The slope values can be found at Ref [4]

• When loading large items of cargo from the ground, it is necessary to consider not only the internal dimensions of the cargo hold, but also the possibility that the bottom or top parts of the cargo contact the airplane during the transition from the inclined ramp to the cargo hold floor. Due to the angle formed by the inclined airplane ramp with the parking ground, the overall length and height of the item are critical factors that must be taken into account during loading operations.

• During loading operations, the ramp is used in either of two positions: open to the horizontal position, or fully open to the ground level.

• When the ramp is closed, it forms an angle with the cargo hold floor, so cargo items eligible for being airlifted on the ramp will be those which can remain in a sloped position in flight. The angle values can be found at Ref [4]

• During aerial delivery operations, the ramp is open to the horizontal position. Ramp extension beyond the floor line in flight is hazardous.

Ramp and cargo door cross section are specified at Ref [4]

The maximum allowable load dimensions on a plane perpendicular to cargo floor as a function of distance to ramp edge is specified at Ref [4]

2.3 CRATED CARGO OVERHEAD PROJECTION

Cargo shall not exceed the geometrical limits which permit to determine the maximum allowable projection of a load from the ramp hinge, according to its height and CG position from its front end in loading direction. These limits are specified at Ref [4]

2.4 WHEELED LOAD OVERHANG AND PROJECTION LIMITS

There are several factors that must be considered to determine if a vehicle can be safely loaded in C295 without contact or projection problems: Front and rear vehicle overhangs, ground clearance from the bottom of the vehicle to the ground, vehicle distance between axles or wheelbase (WB), and cargo floor height from the ramp hinge to the parking ground.
The following figures show these different factors. The method to calculate the minimum vehicle bottom and other critical dimensions is specified at Ref [4]

a) *Figure 1.* Ramp crest contact: The vehicle bottom may contact the vertex of the angle formed by the inclined ramp and the cargo hold floor (ramp crest).
b) *Figure 2.* Overhang limits over the ramp closed: Available distance between the front of the vehicle on board and the closed ramp.
c) *Figure 3.* Overhang ramp and ground contact limitation: Front or rear end of the vehicle may contact the parking ground or ramp.
d) *Figure 4.* Vehicle overhead projection: A vehicle may cause overhead projection problems.

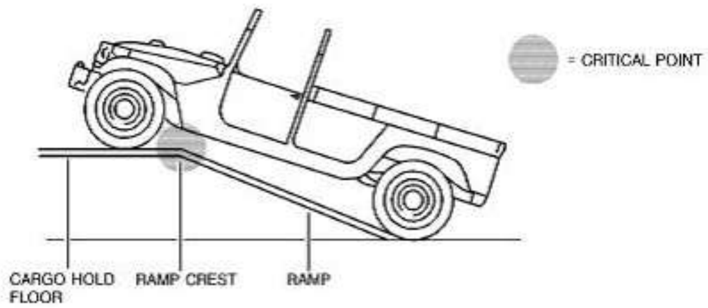


Figure 1 Ramp Crest Contact

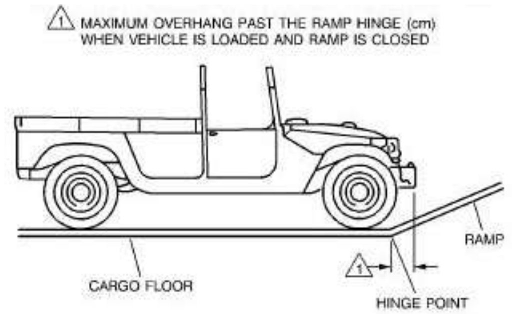


Figure 2 Overhang limits over the ramp closed

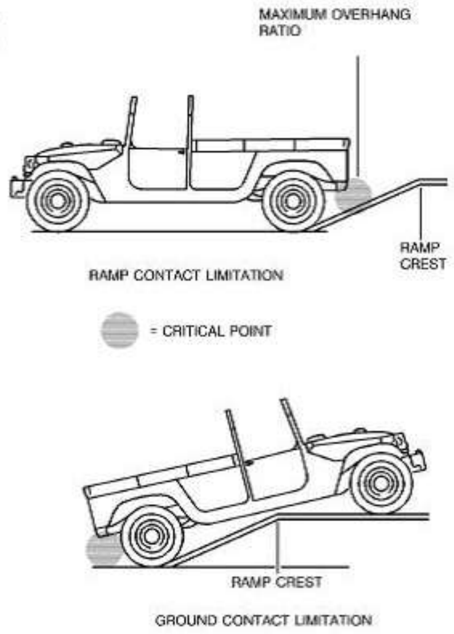


Figure 3 Overhang ramp and ground contact limitation

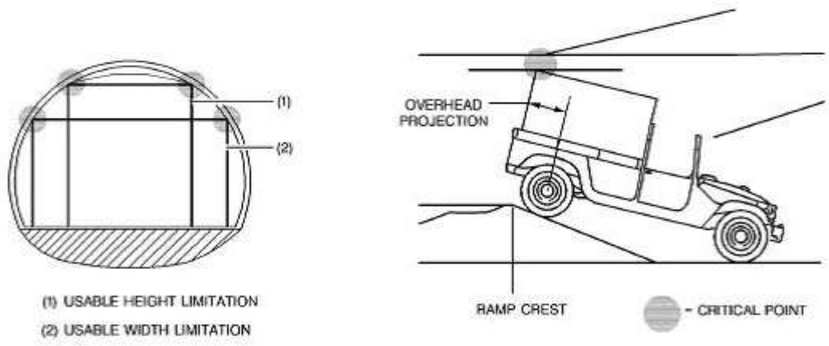


Figure 4 Vehicle overhead projection

3. CARGO FLOOR LOADING CAPACITY

Cargo shall not exceed the running loads of the cargo cabin and ramp. The running load for the cargo zone with the AM109 CHADS is specified at Ref [4] The maximum ramp loading capability (maximum load that can be stored on the closed ramp in flight) is specified at Ref [4] During airdropping, the limit on the ramp is the same as in the cargo zone.

For wheeled loads, the maximum allowable weight per individual axle, the maximum internal pressure of the pneumatic tires, the minimum distance between axles to be considered as individual, and the conditions for considering solid tires and its floor loading capacities are specified at Ref [4]

These limits apply to flight test campaign and during the commercial use of the system.

4. WEIGHT AND BALANCE

The limits on payload weight and C.G. displacement apply to flight test campaign and during the commercial use of the system.

4.1 C295 DESIGN WEIGHTS

The amount of cargo that may be transported in a particular mission depends on the empty airplane weight (basic weight), number of crewmembers, additional equipment and quantity of fuel, etc., whose sum must be equal or less than the maximum allowable weight at take-off and landing.

AAFF system weight shall not exceed the AC maximum payload weight.

	Normal Operation (2.5g)	Overweight (2.25g)
MTOW (kg)	21000	23200
MZFW (kg)	18500	20700
Typical OEW (kg)	12500	
Max. Payload (kg)	6000	8200

Table 1. C-295 Design Weights

Typical OEW does not include weight for the system and modifications required.

4.2 CARGO C.G.

According to Ref [1] "*Cargo on the airplane must be distributed so that the centre of gravity of the whole set lies within the permissible limits. Different distributions and quantities of cargo and fuel cause airplane gross weight and CG position to change. An airplane whose centre of gravity is located outside its prescribed permissible limits, will experience performance degradation (instability, increase in take-off distance and landing ground run, decrease in service ceiling, increase in stall speeds, etc.). The aircraft will only be cleared for take-off when it is guaranteed that its gross weight and CG will be within the prescribed limits, during all flight phases until landing. Except in the event an in-flight emergency situation arises, flying the airplane in an out-of-limits condition is absolutely forbidden*."

"*Weight and CG location of each cargo unit must be exactly known for the calculated airplane weight and balance to be reliable. The agency, unit or organization offering cargo for air shipment is responsible for providing the aircrew with the correct weight and CG position for each item of cargo*. "

4.2.1 Cargo C.G. Location

The payload allowable forward and aft Centre of Gravity Positions for normal (nominal failure free) and emergency flight conditions under failure conditions are specified at Ref [4]

The probability of an AAFF simple failure or combination of failures that leads to an emergency situation should be extremely improbable.

In order to maximize the possibility of offering the system to aircraft already in service, design close to any of the boundaries should be avoided as far as feasible.

4.2.2 Lateral C.G. Displacement

With the half of the dispensable load, the maximum movement of the lateral cg position of the load for C-295 is specified at Ref [4]

5. PERFORMANCE AND OPERATION

The performance limitations apply to flight test campaign and during the commercial use of the system.

5.1 AIRSPEED LIMITATIONS

According to the Supplement n11 of Ref [2] the following speed limitation shall be applied:

5.1.1 Recommended Airspeeds for Door Operation

The recommended airspeed range for ventral door operation in flight is specified at Ref [4]

5.1.2 Recommended Airspeeds for Aerial Delivery

The recommended airspeed for aerial delivery is specified at Ref [4]

5.1.3 Minimum Airspeeds for Aerial Delivery

The aerial delivery operation speed can be reduced to the speed limitation for paratroopers (specified at Ref [4]) above 1000ft. Below that altitude (1000ft) the drop speed will be at least the recommended airspeed for aerial delivery (see 5.1.4)

5.1.4 Maximum Airspeed for Aerial Delivery

The maximum permissible airspeed for aerial delivery is specified at Ref [4]

5.2 MANOEUVRING FLIGHT LOAD FACTORS

The flight manoeuvring load factor range for which the operation with the ventral door open is approved is: 0 to +2g.

5.3 FLAPS DEFLECTION

The flaps deflection is specified at Ref [4]

5.4 NIGHT/DAY OPERATIONS

The minimum safe altitude for night aerial delivery operations will be 1000ft AGL. Below 1000ft AGL, the aerial delivery will be made under VFR (Visual Flight Rules), and in consequence only day operations will be made below 1000ft.

5.5 MINIMUM CREW

According to Attachment nº11 of the Ref [2] *"In addition to the minimum crew required by the basic Airplane Flight Manual, a third crewmember acting as a loadmaster is required."*

"NOTE: In the interest of expediency, it is recommended that an assistant loadmaster be added to the minimum flight crew."

5.6 CARRIAGE OF PERSONS

According to Attachment nº11 of the Ref [2] *"When conducting cargo aerial delivery operations, no person shall be carried who is not a part of the minimum crew, a crewmember trainee, or who is not necessary for the safety of the airplane during flight."*

6. STRUCTURE

AAFF system structure must be able to support flight loads according to CS 25.301 to CS 25.351.

The AAFF system deformations shall not modify the structural stiffness of the cabin.

Table 2 shows the ultimate inertia forces that the aerial platform must be able to support in case of emergency landing conditions. (CS 25.561)

Direction	g's
Upward	3
Forward	9
Sideward	3
Downward	6
Rearward	1.5

Table 2. Ultimate inertia forces in emergency landing conditions

Table 2 is applicable during the commercial use of the AAFF system.

If AAFF breaks down under the crash landing loads, the debris produced by the breaking shall not injure the mission crew.

7. CARGO RESTRAINT

According to Ref [1], *“all items in the airplane are subjected to forces caused by airplane movement (flight in turbulence, direction and speed changes, take-offs, landings, etc.). These forces, which are stronger in certain directions, will tend to shift cargo unless it is firmly secured to the airplane”.*

Shifting of cargo in flight, even small items, may modify in the airplane balance, injure passengers, or damage airplane equipment.

In consequence, all cargo and items in the airplane must be restrained so they will not shift during any flight condition. Forces caused by different flight conditions tend to move the cargo in a forward, aft, lateral (side-to-side), or vertical direction, or in any combination of them. These forces are directly proportional to the cargo’s weight. The ratio between the cargo’s weight and the maximum force that will act in each direction is called the load factor, expressed in Gs, representing times the item’s weight is multiplied due to forces acting on it.

7.1 RESTRAIN CRITERIA

Cargo must be secured so it will not move in any of the following directions:

a) Upward
b) Sideward
c) Forward or rearward
d) Turning
e) Tipping over sideward
f) Tipping over forward or rearward

Minimum restraint criteria, for aerial delivery and cargo transport is expressed in *Table 3*

Load Factors Required	Cargo transport		Aerial delivery
	Cargo Cabin	Ramp	Cargo cabin
Forward	9.0 g	9.0 g	3.0 g
Rearward	1.5 g	1.5 g	1.5 g
Sideward	1.5 g	1.5 g	1.5 g
Upward	5.0 g	5.5 g	2.0 g
Downward	7.5 g	8.0 g	4.0 g

Table 3. Minimum restrain criteria

The AM109 CHADS provides restraint of pallets and platforms to the ultimate factors indicated on *Table 3*

7.2 CARGO HOLD FLOOR

The cargo shall be restrained using the available cabin elements.

The cargo floor comprises:

a) Four (4) longitudinal restraint tracks for installing the framing for a centre row of seats, stretchers and removable tie down rings for securing loads.

b) Aluminium panels bolted to the longitudinal and cross beams that constitute the supporting framework of the airplane floor; these floor panels are separated from each other by the four restraints tracks; the cargo floor is covered by sheets of non-skid material to facilitate vehicle grip and movement of personnel.

7.2.1 Removable Tie-Down Rings

The cargo shall be restrained using the available cabin elements.

The 3D model, PN, weight, technical specifications and arrangement on the cabin of the tie-down rings are specified at Ref [4]

8. STATIC LINES AND ANCHOR CABLES

According to Ref [1], *“The static line anchor cables are used for attaching the parachute static line hooks, either during personnel airdrop with parachute automatic opening, or the aerial delivery of cargo requiring the use of static lines: containers (CDS), low velocity Heavy Equipment airdrop (HE) with the Static Line/Connector Strap extraction system (SL/CS), and Gravity Ejected Platforms (GEP)”.*

The dimensions of the anchor cables and the static lines are specified at Ref [4]

For the retrieval of the static lines, each cable has a movable stop and a Teflon spool which serve as a stop for the static line hooks; the spool can be connected to a static line retrieval sling, which has loop on each end, for manually retrieving the static lines, with or without the aid of a tiedown strap.

There will be not AAFF items hooked from static lines that compromise safety of the C295 operation. Special considerations about weight and aerodynamic drag of these items shall be taken into account

9. PELLETS MATERIAL

According to Ref [3] "*Dangerous goods are articles or substances which are capable of posing a risk to health, safety, property, or the environment and which are shown on the list of dangerous goods issued by the UN Expert Committee.*"

If pellets stuffing material can be considered as a dangerous good, then the next consideration will be taken into account:

Dangerous good than can be transported by air must be properly identified, classified, packed, marked, labelled and documented. This allows alert people working with these items to achieve higher level of safety.

10. SAFETY REQUIREMENTS

There will be not AAFF system failures that compromise safety of the C295 operation.

10.1 AAFF SYSTEM STRUCTURAL FAILURE WITH FRAGMENTS

In order to avoid an UERF (uncontained engine rotor failure) particular risk analysis (PRA), the probability of the AAFF system breaking into fragments should be extremely improbable.

10.2 PELLETS CONTAINMENT LEAKAGE TOWARDS THE CABIN UNDERFLOOR

Since the equipment installed in the aircraft underfloor compartment is not waterproof qualified, and each of the “boxes” formed by the intersection of frames and stringers are not watertight, AAFF system shall be designed to avoid any possible leakage.

a) AAFF system will withstand the flight loads during its entire life (this can be reduced to withstand the loads during the flight trials), to avoid structural failures.
b) Only during the flight test campaign the fatigue effects on the structure will not be considered (due to the reduced number of flights)
c) AAFF designers must pay special attention to sealing failures of the dispenser.

10.3 HAZARDOUS ELEMENTS

AAFF system will not content any explosive, toxic or flammable element.

11. GENERAL ENVIRONMENTAL REQUIREMENTS

11.1 LIGHTNING PROTECTION

AAFF design shall include techniques to minimize the effects of lightning strikes. The critical or essential systems shall be installed so as to ensure that operation and operational capabilities of the systems to perform these functions are not adversely affected when airplane is exposed to lightning.

Critical and essential equipment shall be qualified against indirect effects of lightning by RTCA-DO-160 and AC 20-136.

11.2 EMI/EMC PROTECTION

The C-295 aircraft shall be protected against the effect of internal and external electromagnetic interference; therefore the electrical and electronic equipment, and systems are electromagnetically compatible among them (Intra-System) and with environments caused by electromagnetic effects external to aircraft.

The C-295 aircraft shall be protected against the effect of internal and external EME, by EMI equipment qualification, aircraft systems and equipment installation design.

All equipment shall be EMI qualified by RTCA-DO-160 and by MIL-STD-461.

The aircraft as an integrated system for EMC Intra-System shall maintain compliance with FAA requirements FAR-25.1353 and FAR 25.1431, and for Inter-System HIRF compatibility in accordance to FAA Notice N8110.67

PART B:

AAFF SYSTEM INTEGRATION ON CL-215/415 AND HELICOPTER S-61

1. AAFF INTEGRATION ON CL-215/415

The CL-415 is not suitable for dropping pellets because of its narrow doors (new 4 doors vs. the 2 doors on the CL-215)

The CL-215 is suitable for dropping pellets without any additional design changes to the platform. The solution could be to fill the Cl-215 water tanks from the water outlet windows in the side of the airplane. The pellets will be loaded manually to these two tanks.

2. AAFF INTEGRATION ON HELICOPTER S-61

Deliverable D7.2.1 “Helicopter AAFF Survey Report” concluded that the most suitable helicopter to carry the AAFF pellets is the S-61 “Sea King” helicopter.

Note: ELBIT is trying to find a solution to perform pellets dropping by a special tank developed for this purpose carried as a slung tank but fin stabilized.

2.1 S-61 MODIFICATION

No need for platform modification for S-61 with Belly Tank (The modified belly tank will be installed on 4 existing brackets mounted on the belly of the S-61 that are capable to carry 4.5 tons.

2.2 KAMOV 32, SUPER PUMA OR ANY CARGO HELICOPTER MODIFICATION

In this case no modification will be required to the helicopter. The stabilized slung tank will meet the performance envelope requirement for standard sling load.

2.3 ENGINEERING REQUIREMENTS

A solution for pellets loading is required

PART C:

LOGISTICS ACCESSORIES AND TOOLS

1. LOGISTICS ACCESSORIES AND TOOLS

At the moment of this document was written, the system architecture was just defined, and the "logistic accessories and tools" that will be used at AF3 project cannot be defined in detail.

The description for the logistic accessories and tools will be included in D.7.2.5

PART D:

POST MISSION DEBRIEF AND ANALYSIS SYSTEM

1. INTRODUCTION

A mission debriefing session can be defined as “A professional discussion of an event, focused on performance standards, that enables people to discover for them what happened, why it happened, and how to sustain strengths and improve on weaknesses.".

A debriefing is NOT:

- A stress-management session or psychotherapy
- A search to focus on negative emotions or stress
- A search for scapegoats or individuals to blame

One of the key elements of the post mission debrief and analysis system is the provision of the computer system which provides the feedback capture system. This system will be deployed and accessed from the ground debrief system. During the post mission debrief the system will draw information from the team, and it is usually conducted immediately following the mission.

It is foreseen that the post mission debrief process shall be a combination of manual data captured from the mission team in addition to the integration of automated data that is obtained from the platforms on which the fire fighter mission was operated.

2. SKYTEK – POST MISSION CHECKLIST SOLUTION

One of the post mission debrief tools which will be deployed on the ground AF3 will be the Skytek will integrate a post mission checklist solution which will provide a series of debrief procedures in an electronically accessible and executable format for the team to complete. The debrief checklist will be customized and tailored for the team members based on the following criteria:

- The actual mission goals being performed.
- The captured automated data obtained from the instrumentation and hardware deployed on the mission.

The focus of the provided post mission checklist and mission debrief will be under the following categories:

1) What happened?

Replay event - identify significant events and decisions. This approach gives the team member a chance to validate his or her own perceptions, and it gives the debriefing critical insight into his or her judgment abilities.

2) What went well?

Builds team and individual confidence.

3) What can we improve?

Addresses key areas, and team expectations and process in addition to specific firefighting issuing during the mission.

4) What could have been done differently?

Identify a range of scenarios and the pro's/con's of taking a different approach. This highlights the key things that team member would have, could have, or should have done differently.

5) What will we do to better prepare for future events?

Identify better operational procedures, training, tools and techniques.

The output of the team performing the mission debrief using the Skytek post mission checklist solution will be a debrief report which integrates the manual information of the team in addition to the integrated automated data readings. The format of the reports shall be both in human readable format and in a computer readable XML format which will allow the information and data to be further interpreted and analysed by other systems that are deployed in the mission debrief ground based system.

The Skytek post mission checklist solution is a web application that is currently fully functional accessible from the major web browsers such as Chrome, Firefox and Internet Explorer. The system is a web application that will be deployed on the ground defried system. The debried procedures are defined and stored in XML format and transformed for displayed within the web browser environment, further tailored by mission and automated data availability and content. The solution is based on a single common code base using the latest in JavaScript & HTML5 concepts to provide a responsive and visual appealing GUI to the end users. The mission debrief procedures are rendered on the ground debrief systems screen device in a fluid, flexible manner, scaling to best fit the available screen resolution.

The system provides complete user management for access to the system. This allows for tracking of user access, mission debrief completion and report generation and a per team member level. The system servers integrates with the automated data provisioning systems to extract and integrate the data feeds into the debrief procedures to allow specific queries and feedback to be obtained from the team members.

Additional support during the mission debrief will be provided through supporting services provided by the system during the debrief procedure execution. These systems include, a full annotation service, where for example team members can access mapping display and highlight specific details during the mission. Full multimedia support shall also be provided to the team member so that additional details can be captured during the debrief using both video cameras and audio if connected to the ground debrief station.

A complete log of all team members mission debrief activities are stored by the Skytek post mission checklist solution. This will allow additional analysis to be performed for example on which team members completed the mission debrief, length of time the debrief took and any system events required to be tracked, in particular if issues arose in interfacing to extract automated data.

3. C-295 PLATFORM INSTRUMENTATION

Flight Tests at Airbus DS are usually performed by the C-295 prototype S1, which will be used for the AF3 trials. In consequence, the platform instrumentation is very complete and it contains the necessary instruments to know:

- Aircraft speed
- Engine Torque
- Engine Temperature
- Aircraft Altitude
- Ambient temperature
- Aircraft Attitude: Pitch angle, Angle of attack
- Accelerations (along and normal to the fuselage)
- Forces (weight, weight on wheels)
- Deflections (flaps, elevator)

The C-295 instrumentation that will be used at the trials must be collected in a document called C-295 FTI (where FTI stands for Flight Test Instrumentation)

If more specific instrumentation is required to perform a flight test, a document called FTIR (Flight Test Instrumentation Request) must be written. The design office will study this document, in order to allocate all the required accelerometers and extensometers.

No instrumentation adaption is foreseen for the C-295 instrumentation.

4. SELEXES – FIRE FIGHTING LAB AND THE DEBRIEFING TOOL

Fire Fighting Lab shall be used by the C4I operator to predict the fire evolution. The scenario will be sent to FFL by the C4I system. The C4I used in a real operation will define the entities involved and the location of the fire during a fire operation.

FFL will support the prediction of the fire evolution and uses other tools, included in the AF3 Expert Core engine, to take or evaluate decisions.

All these actions and requests will be stored to debrief purposed by Sim Tac tool provided by UPV.

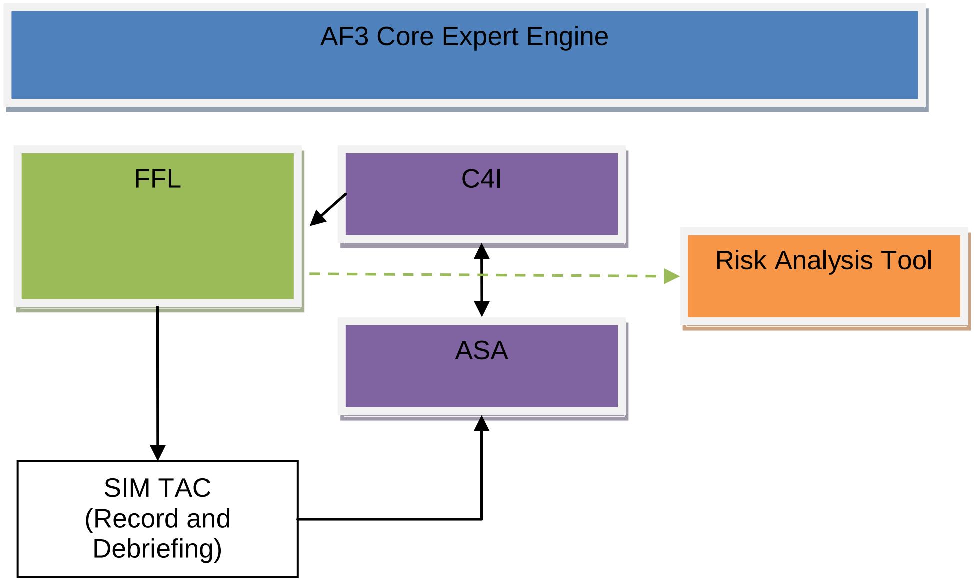
This tool can by consider as a tool available in the set of tools present inside the FFL (e.g. Decision Support).

Sim Tac tool will store the simulated fire evolution information and the data provided by the other AF3 Systems (C4I, ASA, etc).

Each AF3 systems, stimulated as in the workflow below, will allow to debrief the fire operations recorded.

More details regarding the available debriefing functionalities will be clarified with Sim Tac user manual.

Each time C4I will send a new scenario it will be possible to rehearsal an operative mission with the Fire Fighting Lab (FFL).


AF3 Core Expert Engine
FFL
C4I
Risk Analysis Tool
ASA
SIM TAC
(Record and
Debriefing)

CONCLUSION

Along this document, D7.2.2 AF3 system specifications, a first approximation to top level requirements has been assessed.

1. At the first part (PART A), a set of requirements were proposed. The following issues were analysed:
    a. Geometry
    b. Loading Limits
    c. Weight & balance limits
    d. Performance limitations
    e. Structure
    f. Cargo restraint
    g. Safety
    h. ….
2. At the second part (PART B), the operation of the AAFF system onto the CL/215/415 and helicopters was analysed. The main conclusions are that CL415 is not suitable for AF3 project, and that the best solution for helicopters is to use a slung tank
3. The third part (PART C) will be developed on D7.2.5.
4. At the fourth part (PART D), the post mission debriefing and analysis tools were mentioned.