



## INVITATION TO TENDER FOR SOLE SUPPLY CONTRACT

### TENDER SUMMARY AND ADDITIONAL TENDER REQUIREMENTS

The FIA's objective is to select an exclusive supplier of electronic control units (ECUs) whose task it will be to ensure the production and delivery of the ECUs to the competitors in the 2013, 2014 and 2015 FIA Formula One World Championship.

Interested parties are hereby invited to tender to become the exclusive supplier of ECUs to the competitors in the 2013, 2014 and 2015 FIA Formula One World Championship.

The selected tenderer will be invited to enter into a contract with the FIA that will establish the terms of the tenderer's appointment as exclusive supplier. The exclusive supplier will supply the products directly to the teams (not to the FIA) under terms and conditions to be agreed.

Bids must be submitted in accordance with the FIA's "Invitation to tender for sole supply contract – tendering instructions" available on the FIA's website [www.fia.com](http://www.fia.com).

The FIA reserves the right to make amendments to this invitation to tender at any time and to issue a new invitation to tender.

Publication of invitation to tender:	17 February 2011
<b>Tender submission date:</b>	<b>28 March 2011</b>
Opening date:	29 March 2011
Notification of decision as to selection of tenderer no later than:	2 May 2011

Thereafter, the selected supplier will be required to produce ECUs according to the following timetable:

19 September 2011: Three units and all required development tools available for selective bench testing

28 November 2011: Delivery of one pre-production unit to each team for testing

23 January 2012: Submission of hardware and software design for final FIA approval

- 6 February 2012: Hardware and software designs frozen
- 30 April 2012: Delivery of three units per team
- 2 July 2012: Delivery of three further units per team
- 28 January 2013: Delivery of all pre-ordered units for use prior to commencement of the 2013 season (further units to be supplied on demand)

Additional Tender Requirements (pursuant to clause 1.1.11 of the "Invitation to tender for sole supply contract – tendering instructions"):

Each tenderer must attach a copy of its proposed SUPPLY AGREEMENT to its tender.

DRAFT CONTRACT FOR SUPPLYING ECUs  
IN THE 2013, 2014 AND 2015 FIA FORMULA ONE WORLD CHAMPIONSHIP

BETWEEN

**THE FEDERATION INTERNATIONALE DE L'AUTOMOBILE (FIA)**

Chemin de Blandonnet, 2  
CH 1215 Geneva 15 - Switzerland

hereinafter referred to as the "**COORDINATOR**"

ON THE ONE HAND,

AND

[•]

hereinafter referred to as the "**PROVIDER**"

ON THE OTHER HAND.

## **PART 1 - GENERAL CONDITIONS**

### **RECITALS**

- (A) The COORDINATOR's authority in relation to international motor sport has been recognised since 1904 when national automobile clubs came together to establish the FIA to provide, amongst other things, an international forum to regulate motor sport internationally.
- (B) The COORDINATOR is the sole body governing international motor sport and is recognised by its members as the sole authority having the sporting power with the right to organise international FIA championships, including the CHAMPIONSHIP.
- (C) The COORDINATOR has an absolute obligation conferred on it by its members to safeguard its authority over all safety, sporting, technical and disciplinary matters relating to the CHAMPIONSHIP, as well as traditional values.
- (D) The COORDINATOR will continue the publication annually of the GOVERNING RULES.
- (E) The COORDINATOR has determined that the interests of the CHAMPIONSHIP require that a single supplier of the PRODUCT should be appointed for a limited term.
- (F) It is intended that the COORDINATOR and the PROVIDER will enter into this CONTRACT pursuant to which the PROVIDER will be appointed as the sole supplier of PRODUCT to the CHAMPIONSHIP for the term set out herein.

### **1. APPOINTMENT AND SUPPLY**

- 1.1 The COORDINATOR hereby appoints the PROVIDER to be the exclusive supplier of the PRODUCT to the COMPETITORS for the CHAMPIONSHIP and the PROVIDER hereby accepts this appointment and agrees to supply the PRODUCT to the COMPETITORS for the CHAMPIONSHIP in accordance with the terms of this CONTRACT and the terms of the SUPPLY AGREEMENTS.
- 1.2 Following from its appointment, the PROVIDER shall enter into a SUPPLY AGREEMENT with each COMPETITOR setting out the terms upon which the PRODUCT shall be supplied.
- 1.3 The PRODUCT that is supplied by the PROVIDER to the COMPETITORS shall be compliant with the TECHNICAL REGULATIONS, the SPORTING REGULATIONS and the TECHNICAL SPECIFICATIONS.

- 2. RELATIONS BETWEEN THE PROVIDER AND THE COMPETITORS**
- 2.1 The PROVIDER shall treat all COMPETITORS in accordance with the PRINCIPLES OF SPORTING EQUALITY.
- 2.2 The PROVIDER shall supply the PRODUCT to all COMPETITORS on equivalent terms. It shall enter into a standard SUPPLY AGREEMENT with each COMPETITOR.
- 2.3 All SUPPLY AGREEMENTS shall be fully compliant with the PRINCIPLES OF SPORTING EQUALITY, the CONTRACT and the SPORTING REGULATIONS and TECHNICAL REGULATIONS.
- 2.4 Separate from the SUPPLY AGREEMENT, the PROVIDER shall be free to enter into separate agreements with COMPETITORS, containing such commercial terms, including, for the avoidance of doubt, in relation to advertising, publicity and other promotional arrangements, as those parties may agree. However, any such arrangements must not compromise the PRINCIPLES OF SPORTING EQUALITY, or be contrary to the SUPPLY AGREEMENT entered into with all COMPETITORS. In particular, the conclusion of any supplemental arrangement must in no way confer any sporting advantage upon one COMPETITOR over another.
- 2.5 Each SUPPLY AGREEMENT requiring a COMPETITOR to purchase the PRODUCT for use at more than one EVENT shall include a clause permitting the COMPETITOR and/or PROVIDER to terminate the SUPPLY AGREEMENT without a penalty of any kind in the event of expiry or earlier termination of the CONTRACT.
- 2.6 If requested by the COORDINATOR, the PROVIDER shall supply a copy of each SUPPLY AGREEMENT in order to demonstrate that the PRINCIPLES OF SPORTING EQUALITY are maintained. With respect to the COORDINATOR, the PROVIDER hereby waives and confirms that it shall not assert or seek to rely on any confidentiality provision in any SUPPLY AGREEMENT or other agreement relevant to the supply of the PRODUCT to prevent the COORDINATOR from reviewing relevant agreements or carrying out its regulatory functions (including ensuring that the PRINCIPLES OF SPORTING EQUALITY are maintained).
- 2.7 The COORDINATOR may request amendments to a SUPPLY AGREEMENT if it considers that the SUPPLY AGREEMENT is not consistent or compatible with, or is otherwise contrary to, the PRINCIPLES OF SPORTING EQUALITY. For the avoidance of doubt, the PROVIDER's obligation to abide by the PRINCIPLES OF SPORTING EQUALITY shall not be limited or otherwise affected by the COORDINATOR's review of a SUPPLY AGREEMENT and/or a request for an amendment to be made.
- 2.8 In the event of uncertainty regarding whether any action taken or proposed to be taken by the PROVIDER may breach the PRINCIPLES OF SPORTING EQUALITY, the PROVIDER shall request guidance from the COORDINATOR, which shall make a determination in this regard. Where

such a determination is made by the COORDINATOR, the PROVIDER's actions in complying with that determination shall be deemed to be in compliance with the PROVIDER's obligation in GENERAL CONDITION 2.1 to treat all COMPETITORS in accordance with the PRINCIPLES OF SPORTING EQUALITY.

### 3. **LIABILITY**

3.1 Without prejudice to the COORDINATOR's other rights, the PROVIDER shall indemnify and hold harmless the COORDINATOR from and against all reasonably foreseeable losses incurred by the COORDINATOR as a direct result of the PROVIDER's:

- (a) failure to supply the PRODUCT of the requisite quantity;
- (b) failure to supply the PRODUCT of the requisite quality; and
- (c) negligence in the supply of the PRODUCT.

3.2 The PROVIDER represents and warrants that it is in a position to meet any liability that may arise under clause 3.1 of this CONTRACT and hereby covenants to maintain such position for the period of time during which the PROVIDER may be liable.

### 4. **WARRANTIES**

4.1 The PROVIDER represents and warrants that it has full power and authority to enter into and fully perform its obligations under the CONTRACT and the provisions of the CONTRACT, when executed, will constitute valid and binding obligations on the PROVIDER in accordance with its terms. The PROVIDER also represents and warrants that it has full power and authority to enter into and fully perform its obligations under the SUPPLY AGREEMENTS when executed.

4.2 The COORDINATOR represents and warrants that it has full power and authority to enter into and fully perform its obligations under the CONTRACT and the provisions of the CONTRACT, when executed, will constitute valid and binding obligations on the COORDINATOR in accordance with its terms.

### 5. **TERMINATION**

5.1 Notwithstanding any other provision hereof, either party may terminate the CONTRACT with immediate effect by written notice to the other if any of the following events occur:

- (a) the other party has committed a material breach of the CONTRACT which is not capable of remedy or, if remediable, has not remedied it within 30 days of the non-breaching party's written notice requiring the default to be remedied (for the avoidance of doubt, a breach by the PROVIDER of any of GENERAL CONDITIONS 1.2, 1.3, 2, 3 and 4.1 and any of the SPECIAL CONDITIONS is acknowledged by the parties to be a material breach);

- (b) steps (including any steps analogous to those following) have been taken to wind up the other party or to place the other party into administration or to have a receiver appointed over any of its assets, other than as part of a scheme of solvent reconstruction or amalgamation; or
- (c) the other party shall cease or threaten to cease carrying on business or the other party shall make any composition or arrangement with its creditors or become subject to any other insolvency process or proceeding (other than as part of a scheme of solvent reconstruction or amalgamation) or have all or any of its assets or undertakings seized by a government or governmental agency or authority (including any acts analogous to the above).

## **6. GOVERNING RULES**

- 6.1 The GOVERNING RULES constitute the legal, administrative and technical framework of the CHAMPIONSHIP and the conditions set forth therein shall have binding force and prevail among the parties to the CONTRACT.
- 6.2 The CONTRACT shall in principle be interpreted in a manner that gives effect to the provisions of the GOVERNING RULES, the intention of the parties being to construe the provisions of the CONTRACT in the context of the more general framework of the GOVERNING RULES.
- 6.3 The PROVIDER acknowledges that the TECHNICAL SPECIFICATIONS and GOVERNING RULES are subject to amendment from time to time. The PROVIDER will be responsible (at its own cost) for all research and development associated with the manufacture of the PRODUCT, including the making of any changes to the PRODUCT to be supplied pursuant to the CONTRACT that may be necessitated by any amendment to the TECHNICAL SPECIFICATIONS or the GOVERNING RULES.

## **7. GOVERNING LAW AND LANGUAGE**

- 7.1 The language that shall prevail for the interpretation of the CONTRACT shall be English and the CONTRACT and all documents connected with the CONTRACT shall be written in English. In the event of any conflict between the language of the CONTRACT and any translation thereof, the language of the CONTRACT shall prevail. In the event of any conflict between the language of any document connected with the CONTRACT and any translation thereof, the language of the document connected with the CONTRACT shall prevail.
- 7.2 The governing law of the CONTRACT shall be French law.
- 7.3 The Tribunal de Grande Instance de Paris, France, shall have sole jurisdiction to settle any dispute that may arise between the COORDINATOR and the PROVIDER in connection with the CONTRACT.

8. **GENERAL**

8.1 Nothing in the CONTRACT guarantees or shall be construed as guaranteeing, the solvency of a COMPETITOR. The COORDINATOR is not responsible for ensuring that the COMPETITORS satisfy the terms of the SUPPLY AGREEMENTS and the COORDINATOR shall not be liable for a failure by any COMPETITOR to satisfy the terms of a SUPPLY AGREEMENT.

8.2 No delay or omission or failure to exercise any right or remedy provided herein shall be deemed to be a waiver thereof.

8.3 The CONTRACT shall be binding on and enure to the benefit of the parties and their respective successors and permitted assigns. The PROVIDER shall not be entitled to assign or sub-contract its rights or obligations under the CONTRACT in whole or in part without the prior written consent of the COORDINATOR.

8.4 Any notice to be given under the CONTRACT shall be given in writing delivered to the other party by any one or more of the following methods:

(a) personal delivery to one of its corporate officers, in which case notice shall be treated as having been given at the time of such personal delivery;

(b) first class registered post or courier delivery service (such as DHL or UPS) to the address mentioned above (or such other address as may be notified to the other party in writing from time to time), in which case notice shall be treated as having been given on the date of actual receipt at that address (or on the next local business day if delivered on a local non-business day or after 4.00 p.m. local time on a local business day), which shall rebuttably be presumed to be the second local business day after posting; or

(c) facsimile to the numbers below (or such other facsimile number as may be notified to the other party in writing from time to time), in which case notice shall be treated as having been received at the time of actual receipt (or on the next local business day if delivered on a local non-business day or after 4.00 p.m. local time on a local business day) and rebuttably be presumed to have been duly received at the time indicated on the automatic acknowledgement transmitted by the recipient fax machine:

PROVIDER: [•]

COORDINATOR: [•]

8.5 Any variations of the CONTRACT shall be ineffective unless agreed in writing and signed by the parties.

8.6 If any term, provision or condition of the CONTRACT is held by a court of competent jurisdiction to be invalid, void or unenforceable such invalidity,

voidness or unenforceability shall not invalidate the remainder of the CONTRACT, all of which shall remain in full force and effect.

- 8.7 The CONTRACT may be executed in any number of counterparts (whether original or facsimile counterparts) and upon due execution of all such counterparts by all parties, each counterpart shall be deemed to be an original hereof.
- 8.8 GENERAL CONDITIONS 3, 7 and 8 shall survive expiry or termination of the CONTRACT for any reason (but shall terminate at the time expressly provided in the relevant GENERAL CONDITION, if any).

## **PART 2 - SPECIAL CONDITIONS**

*[The CONTRACT shall contain, inter alia, the following minimum terms and conditions relating to the supply of the PRODUCT.]*

### **1. SUPPLY OF THE PRODUCT**

- 1.1 The COORDINATOR does not guarantee the PROVIDER a minimum quantity of the PRODUCT to be supplied.
- 1.2 The SUPPLY AGREEMENT as approved by the COORDINATOR may not be altered in any way during the CONTRACT without the express consent of the COORDINATOR.
- 1.3 The SUPPLY AGREEMENT may provide that each COMPETITOR shall be responsible for the care and maintenance of the PRODUCT and for transportation of them to each EVENT.

### **2. PRODUCTION DATES AND DELIVERY OF THE PRODUCT**

- 2.1 The PROVIDER shall make available to the COORDINATOR, at the PROVIDER's own cost, no later than 19 September 2011, three prototypes of the PRODUCT for selective bench testing. These units will subsequently be upgraded to the final specification agreed on 6 February 2012.
- 2.2 No later than 28 November 2011, the PROVIDER shall make available to each of the COMPETITORS one pre-production of the PRODUCT, at the PROVIDER's own cost. The PROVIDER shall make such arrangements for the delivery of the PRODUCT to a COMPETITOR performing private testing as may be reasonably requested, or otherwise agreed, by the PROVIDER and such COMPETITOR. The PROVIDER shall carefully consider any comments or suggestions on the PRODUCT received from the COMPETITORS and from the COORDINATOR.
- 2.3 The hardware and software design specifications of the PRODUCT shall be submitted to the COORDINATOR for approval on or before 23 January 2012 and approved by the COORDINATOR on or before 6 February 2012, after which date no further modifications or alterations to the PRODUCT's specifications shall be permitted without the express consent of the COORDINATOR.
- 2.4 The PROVIDER shall make available for purchase three units of the PRODUCT to each of COMPETITORS for delivery on 30 April 2012 at the latest.
- 2.5 The PROVIDER shall make available for purchase a further three units of the PRODUCT to each of COMPETITORS for delivery on 2 July 2012 at the latest.
- 2.6 The PROVIDER shall make available for purchase to each of COMPETITORS any other units of the PRODUCT ordered for the start of the 2013 season for delivery on 28 January 2013 at the latest. Thereafter, further

supplies of the PRODUCT shall be arranged between the PROVIDER and COMPETITORS in accordance with the SUPPLY AGREEMENT.

- 2.7 The PROVIDER shall make available to each COMPETITOR all necessary technical support personnel and equipment to assist with installation of the PRODUCT during the first three deliveries of the PRODUCT to the COMPETITORS. The PROVIDER should identify the basis on which it might charge for additional "after sales" technical support over and above that needed to install the PRODUCT and the track support detailed in SPECIAL CONDITIONS 2.8 and 2.9. Thereafter, the PROVIDER shall make available a minimum of one technical support person per COMPETITOR for such time until the FIA ENGINEER considers that the installation of the PRODUCT is satisfactory.
- 2.8 The PROVIDER shall ensure that all necessary technical support personnel and equipment is present on-site throughout the duration of each EVENT and, in addition, shall ensure that there shall be at least one appropriately qualified and senior representative of the PROVIDER available for technical support on-site throughout the duration of each EVENT.
- 2.9 To facilitate OFFICIAL TESTING by COMPETITORS, the PROVIDER will be present at its own expense at OFFICIAL TESTING with all necessary spare parts, personnel and equipment to fit and service the PRODUCT. OFFICIAL TESTING will be at a maximum of one location in any one week in or out of season. Locations will be specified by the COORDINATOR.

### 3. **TECHNICAL CONDITIONS**

- 3.1 The PROVIDER shall ensure that the PRODUCT to be supplied is in conformity with the TECHNICAL SPECIFICATIONS and the SPORTING AND TECHNICAL REGULATIONS (in particular Article 8 of the Formula One TECHNICAL REGULATIONS). In addition, the PROVIDER shall supply the PRODUCT that is capable of being used to ensure that COMPETITORS' cars comply with TESTING requirements.
- 3.2 The ECU shall be able to manage all functions running on Formula One cars, including:
  - a) A controller for:
    - a 4 cylinder engine, including maximum fuel mass flow limitation, maximum crankshaft speed limitation, throttle actuation, pneumatic valve air pressure, lambda, fuel pumps, communication with any peripheral actuation unit used for direct and indirect injection and for ignition ;
    - an energy recovery system (ERS), including kinetic energy recovery, exhaust energy recovery, power and energy monitoring, communication with any peripheral ERS actuator ;
    - a power unit torque coordinator and controller ;
    - a 7 speed semi-automatic gearbox, including 2 actuators, ratchet and closed loop types, gear engagement synchronisation, freewheel actuator ;

- a hydraulic multi-plate carbon clutch, including position and pressure control;
- a hydraulic differential ;
- adjustable bodywork sections ;
- a number of digital output drivers including reverse gear, rain lamp, drinks pump.

b) Steering wheel electronics for switch inputs and driver displays.

c) Optionally, a switch panel in the cockpit.

A key facet of the ECU should be its ability to provide high-level diagnostics making it straightforward to use and easy to diagnose faults with the cars systems. These include fault detection for inputs, outputs, power supplies, communication lines and control strategies.

The ECU shall provide a comprehensive set of FIA functions used to enforce and monitor the compliance of the car systems with the Formula One TECHNICAL and SPORTING REGULATIONS.

The ECU should not include strategies considered as driver aids, including traction control, braking control, launch control, auto clutch, automatic gear changing, gear pre-select, multiple gear shift sequences.

The ECU should incorporate a data logger with sufficient capacity, throughput and triggering capabilities to log key system and strategy parameters for the duration of a race.

The ECU should manage data communication to the FIA ADR and marshalling system unit, including feedback signals to acknowledge the physical activation of marshalling lights on the driver display.

- 3.3 Before starting production, the PROVIDER shall submit a detailed technical study to the FIA ENGINEER for written approval and possible modifications according to the observations of the FIA ENGINEER.
- 3.4 The PROVIDER may not make any change to the PRODUCT during the CONTRACT without the express agreement of the COORDINATOR.
- 3.5 The PROVIDER will, to the fullest extent possible and save as otherwise agreed with the COORDINATOR, ensure that all PRODUCTS supplied to COMPETITORS during the CONTRACT are identical and that the performance of the PRODUCTS remains consistent at all times.
- 3.6 The PROVIDER will supply the COORDINATOR and each COMPETITOR with technical information and updates on an equal basis in a timely fashion. Any additional technical information supplied to one COMPETITOR (even on the basis of a request from a COMPETITOR) must be made available to all COMPETITORS on the same basis and without delay.

#### 4. **PROJECT SUPERVISION**

- 4.1 The PROVIDER shall make such modifications to the PRODUCT to be supplied pursuant to the CONTRACT as the FIA ENGINEER may require.
- 4.2 The PROVIDER shall bear all reasonable costs of development of the PRODUCT incurred by the FIA ENGINEER and his support staff, including software tools, looms and test equipment.

#### 5. **PRICING OF THE PRODUCT**

The price of the PRODUCT (in euros) supplied pursuant to the CONTRACT shall be as detailed on the PRICING FORM, which amount shall be inclusive of all taxes and charges and which amount shall not be increased for any reason.

#### 6. **ASSOCIATION RIGHTS**

- 6.1 The COORDINATOR hereby grants the PROVIDER the non-transferable right to describe itself (including in advertising, publicity or other promotional activity) as the Official PROVIDER of the PRODUCT to the FIA or such other title as may be communicated by the FIA to the PROVIDER (or the direct equivalent thereof in other languages)
- 6.2 The ASSOCIATION RIGHTS will be coterminous with the CONTRACT.

The PROVIDER shall not describe its appointment or role as PROVIDER or the CONTRACT other than in terms of the ASSOCIATION RIGHTS. **The PROVIDER acknowledges and agrees that the only entities entitled to create an association with the CHAMPIONSHIP are official partners of the COMMERCIAL RIGHTS HOLDER. The PROVIDER undertakes to restrict marketing its involvement with the CHAMPIONSHIP unless agreement has been reached with the COMMERCIAL RIGHTS HOLDER.**

- 6.3 The COORDINATOR maintains a right to demand the immediate withdrawal or cessation by the PROVIDER of any advertising, publicity or other promotional activity it considers contrary to the CONTRACT or to the reputation or interests of the CHAMPIONSHIP, the COORDINATOR or motor sport in general. The PROVIDER shall immediately withdraw or cease or procure the immediate withdrawal or cessation of any advertising, publicity or other promotional activity in respect of which the COORDINATOR demands withdrawal or cessation.
- 6.4 Any advertising, publicity or other promotional activity undertaken by the PROVIDER pursuant to the ASSOCIATION RIGHTS shall be entirely at the PROVIDER's expense.
- 6.5 The grant of the ASSOCIATION RIGHTS shall not include the right to use any logo or intellectual property belonging to the COORDINATOR (except that the approved description set out in the ASSOCIATION RIGHTS may be used).

6.6 The ASSOCIATION RIGHTS do not create any right for the PROVIDER to associate its PRODUCT with any COMPETITOR. However, subject to GENERAL CONDITION 2.1, the PROVIDER remains free to agree advertising, publicity or other promotional arrangements with a COMPETITOR.

### **PART 3 - DEFINITIONS**

The following terms shall be understood to have the following meanings for the purposes of the "CONTRACT".

- 1.1 **CHAMPIONSHIP** means the 2013, 2014 and 2015 seasons of the FIA Formula One World Championship.
- 1.2 **COMPETITORS** means the racing teams that have been accepted by the COORDINATOR to take part in the CHAMPIONSHIP.
- 1.3 **CONTRACT** means the GENERAL CONDITIONS, the SPECIAL CONDITIONS and the DEFINITIONS.
- 1.4 **COMMERCIAL RIGHTS HOLDER** means Formula One World Championship Limited.
- 1.5 **COORDINATOR** means the Fédération Internationale de l'Automobile (FIA).
- 1.6 **DEFINITIONS** means the definitions set out in this Part 3 of the CONTRACT.
- 1.7 **EVENT** means any event forming part of the CHAMPIONSHIP entered onto the International Sporting Calendar of the COORDINATOR for any year, commencing at the scheduled time for scrutineering and sporting checks and including all practice, qualifying at the race itself and ending at the latest time for the lodging of a protest under the terms of the COORDINATOR's International Sporting Code.
- 1.8 **FIA ENGINEER** shall mean the technician appointed by the COORDINATOR:
  - to carry out all technical checks and controls,
  - to grant any necessary approval in relation to the development and production of the PRODUCT.
- 1.9 **GENERAL CONDITIONS** means the provisions contained in Part 1 of the CONTRACT.
- 1.10 **GOVERNING RULES** means:
  - (a) the International Sporting Code and the Appendices thereto;
  - (b) the SPORTING REGULATIONS; and
  - (c) the TECHNICAL REGULATIONS.

- 1.11 **OFFICIAL TESTING** means tests as defined in and authorised by the Formula One SPORTING REGULATIONS.
- 1.12 **PRICING FORM** means the pricing form provided at **Appendix I** stating the prices at which the PRODUCT will be supplied.
- 1.13 **PRINCIPLES OF SPORTING EQUALITY** means the equal treatment by the PROVIDER of all COMPETITORS with respect to:
- (a) anything which may affect the performance of the PRODUCT;
  - (b) the terms on which the PRODUCT is supplied;
  - (c) the support, access and information made available to COMPETITORS in relation to the PRODUCT; and
  - (d) any other matter which affects or may have an effect, however minor, on sporting performance.
- 1.14 **PRODUCT** means the electronic control units (ECUs) as such term is described in the SPORTING REGULATIONS and TECHNICAL REGULATIONS.
- 1.15 **PROVIDER** means the ECU PROVIDER which tenders and, after selection by the COORDINATOR, enters into the CONTRACT.
- 1.16 **PRODUCTION SITE** means the factory that will produce the PRODUCT supplied pursuant to the CONTRACT.
- 1.17 **SPECIAL CONDITIONS** means the provisions contained in Part 2 of the CONTRACT.
- 1.18 **SPORTING REGULATIONS** means the Sporting Regulations applicable to the CHAMPIONSHIP as published and amended by the COORDINATOR from time to time. The Sporting Regulations are available on the FIA website [www.fia.com](http://www.fia.com).
- 1.19 **SUPPLY AGREEMENT (Appendix [•])** means any agreement, and all amendments thereto, between the PROVIDER and a COMPETITOR pursuant to which the PROVIDER shall supply the PRODUCT to the COMPETITOR.
- 1.20 **TECHNICAL REGULATIONS** means the Technical Regulations applicable to the CHAMPIONSHIP as published and amended by the COORDINATOR from time to time. The Technical Regulations are available on the FIA website [www.fia.com](http://www.fia.com).
- 1.21 **TECHNICAL SPECIFICATIONS** shall mean the ECU Hardware and Software Requirement as attached at **Appendix II**.

Signed

On behalf of the COORDINATOR

On behalf of the  
PROVIDER

In his capacity as

In his capacity as

In      On

In      On

**APPENDICES**

I - PRICING FORM

II - TECHNICAL SPECIFICATIONS

## APPENDIX I

### PRICING FORM

		<b>Prices in Euro inclusive of all taxes and charges</b>
<b>HARDWARE</b>	Hardware development	
	Master control unit <i>Price per unit</i>	
	Driver switch interface <i>Price per unit</i>	
	Driver information display <i>Price per unit</i>	
<b>SOFTWARE</b>	Pre-2013 Embedded software development <i>Price per year</i>	
	Pre-2013 Off-car software development <i>Price per year</i>	
	Embedded software development <i>Price per championship season including official testing</i>	
	Off-car software development <i>Price per championship season including official testing</i>	
	Additional embedded software development <i>Price per man hour</i>	
	Additional off-car software development <i>Price per man hour</i>	
<b>TECHNICAL SUPPORT</b>	Pre-2013 technical installation, track and factory support <i>Price per year</i>	
	Technical track and factory support <i>Price per championship season including official testing</i>	
	Additional track support <i>Price per man day</i>	
	Additional factory support <i>Price per man day</i>	
	Support personnel travel and subsidence	
	Team personnel training <i>Price per man day</i>	
<b>SERVICING</b>	Master control unit servicing <i>Price per unit</i>	
	Driver switch interface servicing <i>Price per unit</i>	
	Driver information display servicing <i>Price per unit</i>	

## APPENDIX II

### TECHNICAL SPECIFICATIONS

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## **1. Introduction**

For 2013 the FIA intends to specify a single Electronic Control Unit (ECU) for Formula One with the aims of supporting the introduction of a new specification powertrain, reducing the cost of racing, removing driver aids and allowing the FIA to check the car's compliance with the Formula One Technical and Sporting regulations.

The single ECU will primarily control the Power Unit, Gear Box, Clutch, Differential and Adjustable Bodywork on the car.

This document provides an overview of the hardware and software functionalities required for the ECU in order to meet the requirements brought about by the Formula One regulations.

A proposal should include annual maintenance and repair requirements and costs, software update support for the duration of the contract in addition to initial development, individual team integration support and track support for each EVENT and OFFICIAL TESTING.

The details of any hardware and software components to be proposed by the supplier for use with the electronics units supplied should be provided.

All parts of the system must be designed to ensure that the system will effectively prevent the use of driver aids including but not limited to traction control, braking control, launch control and automatic gear changing.

## 2. DEFINITIONS

The following definitions are applicable throughout this document:

**Single:** designed according to an FIA specification. Produced and delivered by a single supplier.

**Standard:** designed according to an FIA specification. May be provided by multiple suppliers.

**Proprietary:** developed by a team or by a third party.

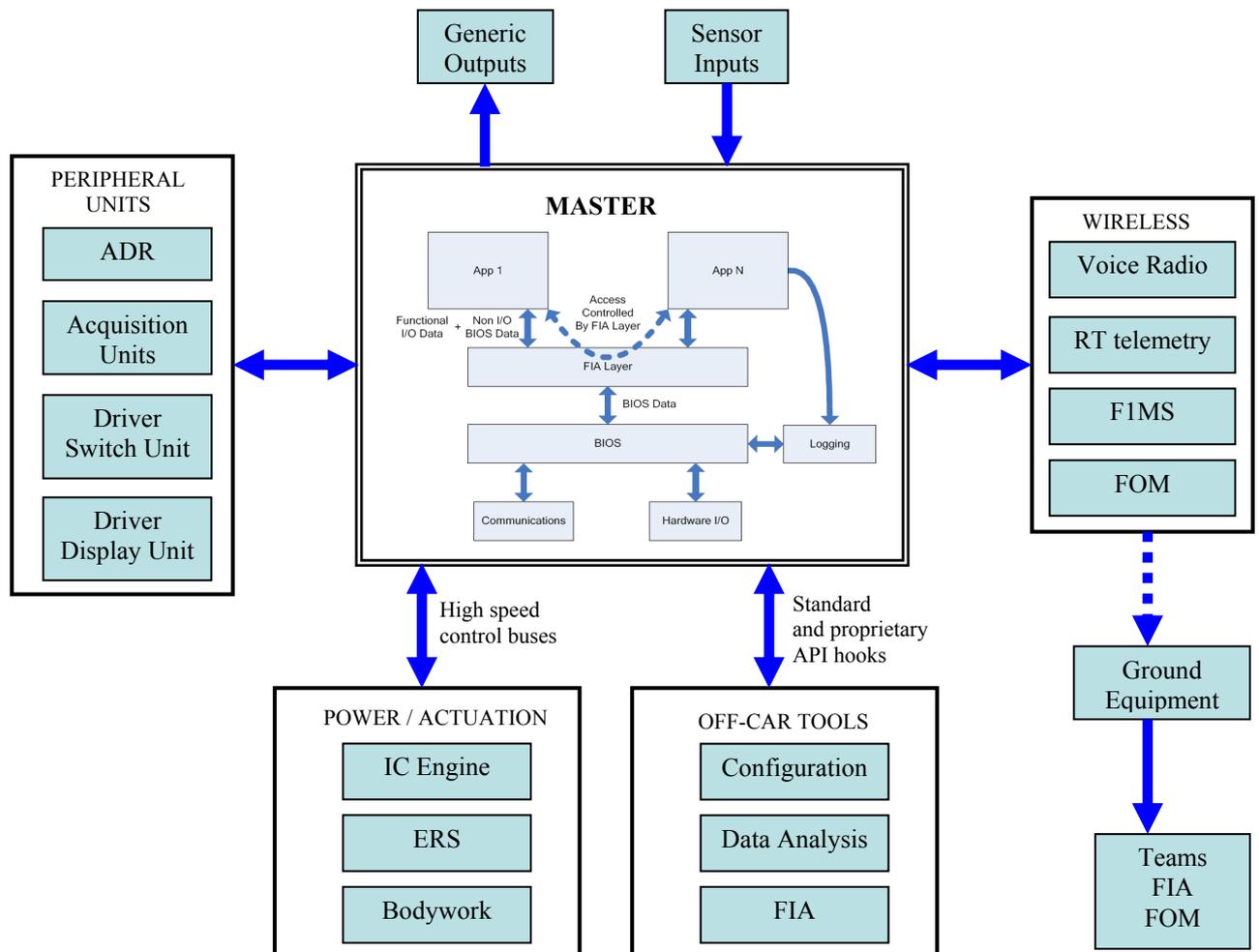
The Electronic Control Unit (ECU) is defined as the combination of the following single components:

- a Master control unit (Master ECU);
- a driver switch interface;
- a driver information display unit.

Any requirement for additional satellite unit should be justified for cost and reliability.

## 3. SYSTEM OVERVIEW

The on-board electronic system will be centred on the Master ECU as outlined below. All on-board electronics will require approval by the FIA.



The ECU shall be able to manage all functions running on Formula One cars, including:

a) A controller for:

- a 4 cylinder engine, including maximum fuel mass flow limitation, maximum crankshaft speed limitation, throttle actuation, pneumatic valve air pressure, lambda, fuel pumps, communication with any peripheral actuation unit used for direct and indirect injection and for ignition ;
- an energy recovery system (ERS), including kinetic energy recovery, exhaust energy recovery, power and energy monitoring, communication with any peripheral ERS actuator ;
- a power unit torque coordinator and controller ;
- a 7 speed semi-automatic gearbox, including 2 actuators, ratchet and closed loop types, gear engagement synchronisation, freewheel actuator ;
- a hydraulic multi-plate carbon clutch, including position and pressure control ;
- a hydraulic differential ;
- adjustable bodywork sections ;
- a number of digital output drivers including reverse gear, rain lamp, drinks pump.

b) Steering wheel electronics for switch inputs and driver displays.

c) Optionally, a switch panel in the cockpit.

A key facet of the ECU should be its ability to provide high-level diagnostics making it straightforward to use and easy to diagnose faults with the cars systems. These include fault detection for inputs, outputs, power supplies, communication lines and control strategies.

The ECU shall provide a comprehensive set of FIA functions used to enforce and monitor the compliance of the car systems with the TECHNICAL AND SPORTING REGULATIONS.

The ECU should not include strategies considered as driver aids, including traction control, braking control, launch control, auto clutch, automatic gear changing, gear pre-select, multiple gear shift sequences.

The ECU should incorporate a data logger with sufficient capacity, throughput and triggering capabilities to log key system and strategy parameters for the duration of a race.

The ECU should manage data communication to the FIA ADR and marshalling system unit, including feedback signals to acknowledge the physical activation of marshalling lights on the driver display.

#### **4. QUALITY AND SAFETY**

It is recommended to follow international quality and safety standards such as ISO 61508 and ISO 26262 for the on-board electrical, electronic and software components.

A proposal should include FMEA and FTA of electronic systems, hardware and software.

Particular attention should be given to the following elements:

- software development process, tools and validation ;
- watchdogs: inter-processor, inter-units, torque controller ;
- fault detection and failure mitigation for inputs, outputs, power supplies, communication lines and control strategies ;
- functional redundancies ;
- torque and acceleration monitoring ;
- stuck throttle safety ;
- driver interfaces and warnings ;
- methods to avoid data corruption, e.g. propagation of Not-A-Number signals.

## **5. NAMING CONVENTIONS**

In order to ease the transition to the new ECU, its understanding and the FIA approval process, the signal and parameter naming convention and dictionary will be based on the 2011 FIA single ECU. They will be extended by the FIA as required.

All signals at the application interface should be defined in functional terms rather than in I/O channel terms (e.g. rThrottlePedal in % rather than VRawAnalog001 in Volts).

All data at the application interface level should be in SI or engineering units.

## **6. HARDWARE**

Only one hardware build will be manufactured.

A proposal should include an overview diagram showing all units of the ECU, their inter-connections and other connections to external units, sensors and actuators.

The following details should be provided for each unit of the ECU:

- mechanical characteristics, including dimensions, weight, case material, connector types and pinout ;
- installation characteristics, including mounting points and guidelines, heat sinks, anti-vibration mounts ;
- environmental characteristics, including storage temperature, operating temperatures (for processors and circuit boards), operating thermal shock, fluid ingress protection, vibration profile, electromagnetic compatibility ;
- electrical characteristics, including supply voltage and current, supply protection ;
- micro-processor characteristics ;
- storage memory characteristics ;
- communications topology and interface characteristics, including all communication links between any part of the ECU system and to any on-car and off-car external unit or PC. The ECU should provide additional expansion capability for powertrain actuation units and team data acquisition units, e.g. Tyre pressure, aero logging ;
- analogue inputs characteristics, including type, quantity, circuitry, range, impedance, resolution, accuracy, filtering, sampling rate, protection, diagnostics, configuration options ;

- digital inputs characteristics, including type, quantity, circuitry, voltage range, impedance, frequency range, resolution, switching/trigger threshold and hysteresis, sampling rate, protection, diagnostics ;
- UEGO inputs characteristics, including type, quantity, circuitry, range, impedance, resolution, accuracy, current control, filtering, sampling rate, protection, diagnostics, configuration options ;
- analogue outputs characteristics, including type, quantity, circuitry, range, resolution, impedance, accuracy, control rate, maximum voltage and current, protection, diagnostics ;
- digital outputs characteristics, including type, quantity, circuitry, voltage and frequency ranges, impedance, current limit, protection, diagnostics ;
- High and Low side drivers characteristics, including type, quantity, circuitry, voltage, frequency range, current limit, protection, diagnostics ;
- diagnostic outputs characteristics ;
- display characteristics ;
- proposed allocation of inputs and outputs to control and monitoring functions managed by the ECU ;
- a list of all internal measurements, including temperatures, accelerations, voltages, currents and the diagnostics associated ;
- internal data acquisition characteristics, including capacity, maximum number of channels, data throughput, triggering modes, logging modes, typical and maximum data offload speed ;
- service intervals and details, life period, quality control.

Each unit will have a unique serial number marked externally and will be sealed and have its identity tracked throughout its entire life cycle.

Each unit must have suitable provision to allow it to be sealed to prevent tampering. It is intended that each team will be permitted to build its own control looms to an approved FIA connectivity specification. A facility to automatically check loom compliance at the track will be required as part of a proposal.

### **6.1 Master ECU hardware**

The Master ECU shall provide hardware circuitry for:

- generic inputs used on conventional F1 cars ;
- generic outputs such as servo-valve, HSD, LSD ;
- spare inputs for additional data acquisition.

Generic communication lines should interface external units including:

- power / actuation units ;
- peripheral units such as FIA ADR, steering wheel, dashboard and data acquisition units ;
- wireless communication units such as real-time telemetry, voice radio, F1MS and FOM.

The Master ECU will connect to off-car tools for unit configuration and data acquisition.

It should incorporate a data logger with sufficient capacity, throughput and triggering capabilities to log key system and strategy parameters for the duration of a race.

## **6.2 Driver switch and display modules**

The display module shall provide information to the driver as commanded by the Master ECU:

- clearly legible alphanumeric information ;
- warning LEDs ;
- a set of marshalling lights as defined by the Formula One regulations.

Feedback signals should be fed to the Master ECU to acknowledge the physical activation of each marshalling light on the driver display.

The raw signals from the driver switch module should be logged by the Master ECU and should provide a true representation of the driver's actions.

## **7. EMBEDDED SOFTWARE**

The ECU will provide real time algorithms that interface via electrical input/outputs to control the functions of a Formula One car. The algorithms should be designed to provide the necessary control with the minimum of complexity.

A proposal should provide details of each control algorithm, including functionality, execution rate, inputs, outputs, diagnostics, team configurations and FIA configurations.

When running the control algorithms, none of the ECU processors should be loaded at more than 40% capacity and none of the communications links used in control strategies should be loaded at more than 50%. This provides scope for future development.

The source code should be made available to all teams for the control applications, the basic input and output processing and for the communication interfaces. This will ensure maximum transparency and will allow the teams to gain a detailed understanding of the functionality of the software and how it will act as part of the control systems. The source code associated with data security and code verification or locking may not be shared with the teams.

Parameters allowing the user to calibrate and configure the strategies should be split between types that can be configured by the team and those only by the FIA.

The ECU should provide the necessary mechanisms to ensure the validity of its programmed code and the protection of its logged data:

- only FIA approved software versions should be able to run on the ECU ;
- a foolproof means to ensure that all software contained within the units is identical to that validated and approved for use ;
- the data logger should have a secure ability to restrict the data logging capability and configurability and to prevent data erasure during race weekends.

## **7.1 Software version verification**

All programmable devices must have a mechanism that allows the FIA to accurately identify the software version or versions that are being used. In order to satisfy this requirement, a range of procedures are available.

- a) Boot code programming should only be possible using a production process from the supplier and when the unit is open.
- b) A dynamic CRC logging methodology may be suitable; subject to filling unused code memory with an FIA supplied random filler sequence. An FIA supplied MD5 or SHA-256 algorithm should be used. Any microprocessor with access to non-code memory of sufficient size to store additional program images may not be considered suitable for this method.

All units that can be reprogrammed via an external connector and that are connected to the Master ECU “control” interfaces are expected to provide this mechanism.

- c) Restricted programming.

Reprogramming of electronic units will be restricted by an approved mechanism that has been established before the electronic unit is first used. The following is a non exhaustive list of possible techniques :

- i) Depending on the design, the FIA sticker or stickers may act as a seal.

Examples: 1) where the reprogramming is via an internal connector, 2) the sticker seals some hatch that gives access to reprogramming.

- ii) Password protection ;

- iii) Application list restriction: typically a list of CRCs or MD5s or SHA-256s of all the allowed program versions that the unit can run. Updating the list requires knowledge of an FIA secret password.

The Master ECU is expected to use this restriction method with MD5 or SHA-256 for each application area.

Any application code area should have a fixed size for each version.

- iv) Signed application code. An FIA private encryption key must be securely stored in each unit. The code will not run unless it has been digitally signed by the FIA.

In all cases there must be a mechanism available to determine the software version in any reprogrammable device. Examples would be: 'program image' verification, upload of 'program image', CRC or MD5 or SHA-256 of the 'program image'. A simple version string communicated by the device is not sufficient. Security 'fuses' or other mechanisms that prevent access to stored 'images' should not be used.

One time programmable devices can be used but subject to the device having an acceptable mechanism for identifying the program version.

Any change in electronic unit software must be registered with the FIA in advance of use.

## **7.2 Master ECU software**

The Master ECU embedded software shall be capable of managing:

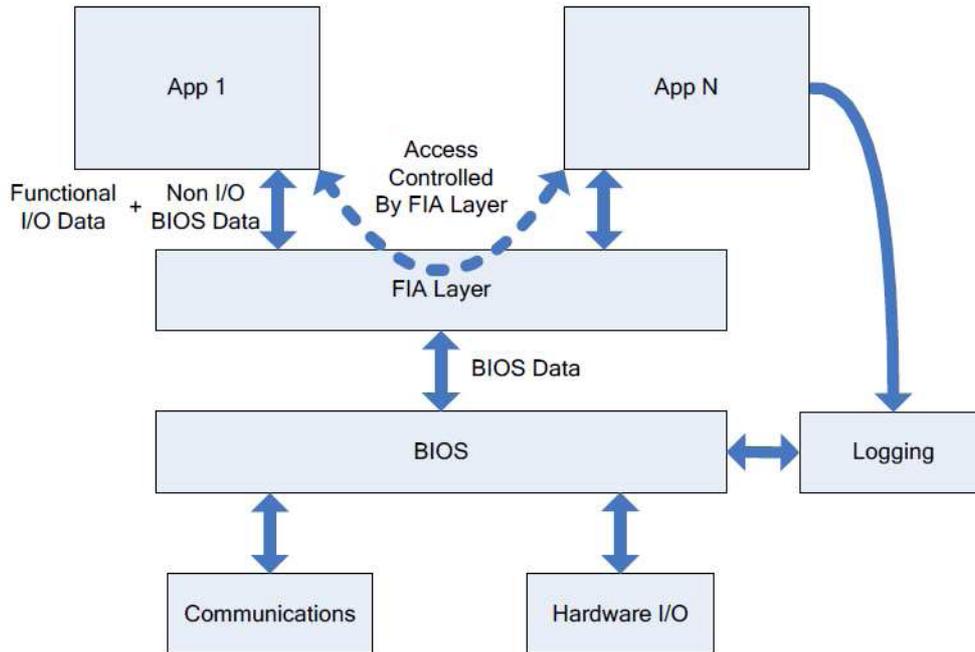
- standard and proprietary software strategies for control systems ;
- single FIA monitoring strategies ;

- proprietary math calculations ;
- proprietary data logging.

The software architecture of the Master ECU has been defined for the following objectives:

- to ensure the legality of all control software ;
- to simplify porting of code ;
- to provide flexibility for the implementation of on-board math calculations.

The structure of the data transfer on the Master ECU shall be as illustrated below.



All I/O activity will pass through the FIA application so that it is able to monitor and control access to the car's systems.

The FIA application will have unrestricted access to all BIOS application data and services.

### **7.2.1 Prerequisites**

- The BIOS must provide memory area protection on a per application basis. It must not be possible for any application to write into any applications' code area, including its own or any other application's data area.
- The BIOS must ensure that applications complete tasks within time boundaries.
- The bootcode must be capable of preventing unauthorised code running, or parameter data sets being used, on a per application basis, including the BIOS.
- Rebuilding or changing any application should not require rebuilding of other applications (ignoring requirements due to functional changes). This will be achieved by runtime mapping of inter-application parameters and signals.
- The Master ECU will support the presence of a BIOS and a number of applications. Initial systems should include at least chassis, engine, FIA and math calculations applications. Additional applications may be defined depending on the team or FIA requirements.

- The BIOS must include such access control scheme that only permits an FIA user to execute the restricted FIA commands.

### **7.2.2 Assumptions**

- It is expected that the application code created for the Master ECU will be automatically generated from Simulink models using automatic code generation, but it should be possible to use hand coded C if desired.
- The same compiler version is expected to be used for all applications on each processor, as defined by the ECU supplier.
- No assumption is made on the number of processors in the ECU, or on the ability of each processor to run application code or BIOS code.

### **7.2.3 Terminology**

In order to provide a common agreement on terms to be used, a standard terminology has to be adopted. The terms will be as much as possible compliant with ASAM standard and MathWorks Real-Time Workshop.

Examples:

- parameters (example: gain of PID) are named as “parameters” or “CHARACTERISTICS”.
- input/output control variables (example: measured battery voltage, inverter duty cycle) are named as “signals” or “MEASUREMENTS”.

### **7.2.4 Customisation definitions**

The supplier’s C code definitions should be declared in header files. The supplier should provide a header file which can be included by the customer in order to fully define all types, and macros. This header file should be robust to multiple inclusions. Nesting of header files will be allowed.

Any additional functions required to support the compiled code may be provided in the form of C source code or library files.

### **7.2.5 Memory areas**

The implementation of memory areas will be left up to the Master ECU supplier, with the following constraints:

- the code area must be write protected at runtime ;
- the parameter area of an application must be read only to that application ;
- memory areas of other applications must not be accessible ;
- non-volatile data must be supported.

### **7.2.6 Hardware abstraction**

Mapping of hardware inputs to functional signals will be managed by the Master ECU BIOS. It will include calibration, zeroing, failure detection and filtering. This should cover conventional inputs and inbound data from communication lines.

Configurable parameters for input allocation and filter frequency should be in the FIA parameter area.

Configurable parameters for scaling, zeroing and failure detection should be in the team parameter area.

Mapping of functional signals to hardware outputs will be managed by the Master ECU BIOS code. This should cover conventional outputs and outbound data to communication lines.

Configurable parameters for output allocation should be in the FIA parameter area.

Communication lines used for the sole purpose of data acquisition will be unrestricted outbound of the Master ECU. Any inbound data flow on such communication lines must be to the Master ECU data logger only.

### **7.2.7 Simulink library and code generation**

To ease the transition to the new ECU and to allow re-use of existing applications, the ECU should be compatible with the application software running on the 2011 FIA single ECU.

To maintain continuity with the existing FIA policing process, the FIA application model will be developed and its code generated using the Simulink library and the code generation tools used for the 2011 FIA single ECU.

The Simulink library will be based on the 2011 FIA single ECU. It will cover the following areas:

- access to BIOS input and output signals ;
- signal and parameter imports from other applications ;
- signal exports for use by other applications ;
- signal exports for logging and monitoring ;
- commonly used blocks requiring configuration parameters ;
- access to BIOS functions such as events logging, task calls, handling of non-control communication lines, ECU reset ;
- list of signals allowed to be imported by an application, including the maximum import rate ;
- list of signals allowed to be exported by an application, including the maximum export rate.

Versions and releases of the library will be controlled by the FIA.

Other applications may be developed and their code generated using other tools pending approval by the FIA.

### **7.2.8 Signal imports and exports**

The Master ECU must prevent any application from directly accessing I/O signals. Access to BIOS data and shared data between applications will be controlled by the BIOS and by the FIA application.

The signals import/export concept will allow the FIA application to control the flow of data between applications whilst removing the task of moving data between applications and processors from the applications' developers.

For each control application, whether inside or outside the Master ECU, the FIA application will supply the lists of input and output signals that the control application is allowed to access. The maximum access rate will also be configurable for each input and output.

The BIOS will resolve all the imports and exports according to the FIA application's lists before running the control application initialisation. The BIOS will search the applications in order to find the required signals. The request will include all desired attributes. These attributes must be exactly matched in order to allow access to the data. If no match is found, the Master ECU will not execute the application code.

The math calculation application will only be allowed to export signals to the datalogger. It may have access to all import signals.

At the refresh rate specified (minimum between the values set in the FIA application and in the control application) the BIOS will populate the registered data with the signals required by each control application.

Parameters (characteristics) should be propagated in the background.

If a parameter or signal is exported from a different processor to that on which it is needed then the BIOS must take responsibility for making it available on any other processor where it may be used.

An application could request to use a parameter or signal that it generated. This would allow the code for that application to be refactored across processors with the BIOS handling the propagation of the parameter or signal values.

### **7.2.9 BIOS calls**

The application code needs to be able to call the BIOS to make use of its available services. These entry points should be defined as macros. These will include for example:

- CAN buffer configuration for non-control communication lines only ;
- CAN receive for non-control communication lines only ;
- CAN transmit for non-control communication lines only ;
- reset ECU.

### **7.2.10 BIOS services**

The BIOS needs to be able to make a number of calls into the application code in order to ask it to perform some tasks. The exact method by which the BIOS makes these calls will be platform dependent, and it is expected that the Master ECU supplier will provide the necessary linker files and executable image post processing tools to allow the BIOS to identify the location of the entry points for each application. For example:

- initialisation ;
- individual task rate calls (1ms, 2ms, 5ms, 10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s) ;
- background task ;
- engine synchronous task.

### **7.2.11 FIA application**

The Master ECU FIA application will include a set of functions used to enforce and monitor the compliance of the car systems with the TECHNICAL AND the SPORTING REGULATIONS.

The systems to be regulated include:

- internal combustion engine ;

- energy recovery systems ;
- gearbox ;
- differential ;
- clutch ;
- adjustable bodywork ;
- driver interfaces for switches and displays.

Power/actuation and peripheral units should transfer signals to the Master ECU as required by the FIA to allow legality monitoring.

The FIA application will be developed as a Simulink model. Versions and releases will be controlled by the FIA.

## **8. MASTER ECU DATA LOGGER**

The Master ECU data logger should include the following features:

- data and events logging for the team and FIA. Separate partitions for FIA and team data is not a requirement ;
- separate logging tables for FIA and team. Allowing the FIA to enforce logging channels at a minimum rate ;
- a comprehensive set of diagnostics for the logger, the team logging configuration and the FIA logging configuration ;
- the data logger memory should be configured to wrap around by default ;
- when FIA locked, the Master ECU should only allow clearing of the logger memory by FIA users ;
- the Master ECU events buffer may only be cleared by an FIA user, regardless of the unit's locked status. The team will be able to clear the events list visible in its PC tool but these events will be maintained in a cyclic buffer in the Master ECU unless cleared by the FIA.
- offload of all data stored in the Master ECU should be possible without any reference to off-car configuration files.

## **9. ACCESS TO MASTER ECU CONFIGURATIONS AND LOGGED DATA**

To assist scrutineering, the FIA requires unlimited access to the following Master ECU information before, during and after any track session:

- configurations for each application (e.g. Chassis, Engine, FIA and BIOS) ;
- logged data and events ;
- real-time telemetry data and events.

Throughout the track Event, the logging memory and events buffer may only be cleared by an FIA engineer.

The FIA must have the ability to connect to the Master ECU via a jump battery using an FIA laptop.

## **10. ADR AND FIA MARSHALLING SYSTEM**

The Master ECU should manage data communication to the FIA ADR and marshalling system unit.

- a minimum of one CAN line should be dedicated to FIA use for connecting to ADR and marshalling system ;
- the CAN messages to the FIA ADR and marshalling system unit should be configurable by the FIA ;
- the FIA should be able to lock the CAN configuration ;
- processing capacity should be provided to view all CAN messages without overrun on 90% loaded bus ;
- feedback signals should be fed to the Master ECU to acknowledge the physical activation of marshalling lights on the driver display.

## **11. FOM FIU**

The Master ECU should manage data communication to the FOM FIU via CAN.

The CAN messages to the FOM FIU should be configurable :

- by the FIA for signals used in control strategies, for example FOM loop identifiers. The FIA should be able to lock this configuration.
- by the team for outbound signals used by the FOM broadcast network.

## **12. OFF-CAR PC SOFTWARE**

PC applications should be provided that manage the ECU configuration, monitoring and data analysis, including:

- editing, viewing, comparison and archiving of parameter datasets for the ECU applications ;
- separate parameter datasets for team and FIA parameters ;
- management of multi-user sub-system parameter datasets ;
- import and export of parameters using the Matlab m-file format specified in the Appendix ;
- power unit and team specific setup data will have individual power unit supplier and team identification. The PC software supplied to teams must recognise this and prevent unauthorised access ;
- recording of set-up change history in human readable log files ;
- calibration of sensors and actuators ;
- specific commands required to manage the ECU functions ;
- loading of ECU embedded software for all or individual applications;
- verification and locking of all code and configuration areas of the ECU by an FIA user ;
- selections of channels from the ECU embedded software and their logging rate in the ECU's internal data logger ;

- selections of channels and their transfer rate from the ECU control applications to the team system via the dedicated communication links ;
- low rate display viewing of channel values via cable link from ECU ;
- communications interface to dynamometer ‘Slew Box’ ;
- offload of the data stored in the ECU’s internal data logger ;
- conversion of the offloaded data to any format specified by the FIA.

### **12.1 Master ECU calibration API**

In order to ensure compatibility with existing proprietary calibration tools, the Master ECU must be able to interface through a standard set of API definitions.

The API definitions will be based on the 2011 FIA single ECU. They will be extended when required to cover at least the following functions:

- loading of ECU embedded software for all or individual applications;
- programming of parameter sets for all or individual applications ;
- ECU status information: connection link, code versions, parameter sets, logging table ;
- FIA and team logging table diagnostics ;
- manual start and stop data logging ;
- clear data logger memory ;
- clear events buffer ;
- verification and locking of all code and configuration areas of the ECU by an FIA user ;
- sending command messages to the ECU ;
- import and export of parameters using the Matlab m-file format specified in the Appendix ;
- low rate display viewing of channel values via cable link from ECU.

Versions and releases of the standard API definitions will be managed by the FIA.

Any licensing related to the calibration tools APIs should be perpetual.

### **12.2 Master ECU data analysis**

In order to ensure accessibility between existing data analysis tools and the Master ECU, the Master ECU supplier should share with other suppliers and teams the necessary API methods to interface with its data server and with saved data files.

Any licensing related to those APIs should be perpetual.

