

FSAE-A Autonomous Vehicle Addendum

Issue v1.0 – May 31, 2022

This Addendum **applies only to vehicles participating in the 2022 Formula SAE-A AV demonstration.**

It defines Revisions and Clarifications versus the Driverless Vehicle sections of the European Formula Student Rules V1.0 2022 (hereinafter referred to as the “EFS Rules”) and the 2022 Formula Student Germany V1 Handbook, for the December 2022 Formula SAE-A AV demonstration.

The Driverless Vehicle Rules as defined in the EFS are adopted for the FSAE-A Event except as revised, amended or deleted per the detail clauses of this Autonomous Vehicle Addendum.

The sections of the EFS Rules that are not Driverless Vehicle related do not apply and all vehicles participating in FSAE-A must refer to the *International 2022 Formula SAE-I Rules* and the *Local Addendum to Formula SAE 2022 rules* (hereinafter referred to as the “Local Addendum”) for the December 2022 Formula SAE-A competition. These cover all the rules requirements for the base vehicle design, construction and operation other than for any Autonomous systems and Autonomous operation of the vehicle.

AV Teams should interpret all references to Driverless Vehicles (DVs) in the EFS Rules as synonymous with Autonomous Vehicles (AVs). Wherever it is not clear as to application of the rules to a proposed vehicle design, or where a radically new concept is proposed for a vehicle, the team should submit the concept to the FSAE-A Rules Committee in advance for clarification and not rely only on the team interpretation of the rules, as they may not have been drafted with this proposed new concept in mind.

Please read all rules carefully

Overview

In 2022, the FSAE-A Autonomous Vehicle (AV) class will be run as a demonstration event, with limited, non-scored static and dynamic events. The event will be held at Winton Motor Raceway, between the 8th and 11th of December 2022, alongside the IC and EV class competitions.

Further details as to the timing and locations of the AV scrutineering, static events and dynamic events will be released in the 2022 Competition Handbook. Where registered AV teams have any questions or concerns regarding the timing or logistics of the 2022 demonstration they are invited to submit clarifications to the organising committee via formulasae@sae-a.com.au .

Document Submission

All electronic document submissions must be uploaded by the Team Leader in accordance with the procedures and timing outlined in the *Local Addendum to Formula SAE 2022 and Appendix PDA-1 of that Addendum*. It is also attached to this Addendum. Submissions will only be accessible by SAE-A event organisers, judges and nominated persons.

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Vehicle Eligibility

Teams may enter AVs that have been developed from vehicles previously entered in the FSAE-A competition, however, to be eligible to participate in the dynamic events all vehicles must comply with the requirements of Clause 7.3.2 of the Local Addendum.

If there are significant potential issues in ensuring compliance for a 2019, 2020 or 2021 vehicle with the 2022 rules and the Local Addendum or this AV Addendum, teams should submit early Rules Queries relating to the issues to the Rules Committee for potential solutions to be achieved.

Rules Enquiries

If you have any questions regarding interpretation of the competition rules or procedures, please follow the steps outlined in the *Local Addendum to Formula SAE 2022 Rules* to submit a clarification.

Resources

Document templates, forms and guidelines are available from the SAE Australasia websites, including documents required for the 2022 AV demonstration.

<https://www.saea.com.au/rules-documents-templates>

The following changes refer to the sections of 2022 EFS Rules sections covering Driverless (Autonomous) Vehicles.

A1 – ADMINISTRATIVE REGULATIONS

EFS Rule	Page	Changes and Clarifications
A1.2.6, A1.2.7	10	Competition Overview In 2022, the FSAE-A Autonomous Vehicle (AV) class will be run as a demonstration event, with limited, non-scored static and dynamic events.
A4.1.1	13	Teams per University Teams who intend to participate in the 2022 AV demonstration must inform SAE-A of their intention to register as detailed in the <i>Local Addendum to Formula SAE 2022 rules</i> and may enter a maximum of 3 vehicles with one entry in each of the IC, EV and AV competitions.
A4.1.2	13	In 2022, some teams may have an IC and/or EV entry in addition to an AV. For the purposes of the AV demonstration, team members involved with vehicles competing in the IC or EV classes may also be nominated as a member of the AV team. A student may thus be an AV/IC or AV/EV team member.

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A5 – DOCUMENTATION AND DEADLINES

EFS Rule	Page	Changes and Clarifications
A5.1.1	13	<p>Required Documents and Forms Delete EFS words and Add;</p> <p>Teams entering 2022 Formula SAE-A AV demonstration must upload the required documents per the Local Addendum to the designated submission site as defined in Appendix A-1 of this Addendum and including the unique to AV submissions:- Autonomous Systems Form; AV Operation Diagram; AV Wiring Diagram; AV Schematic Diagram; AV Mechanical Parts; AV Hydraulic/Pneumatic Systems; Autonomous Systems Design Report; EV-AV Conversion Process (as required) ; AV Inspection Check List.</p>
A5.3	15	<p>Late or Non-Submission Delete EFS words and Add;</p> <p>Failure to meet the deadlines for any of the specified documentation may result in exclusion of the respective vehicle from the AV demonstration.</p>
A5.4	15	<p>Correction Requests Delete EFS words and Add:</p> <p>For the purposes of the demonstration, officials may require corrections to be made in certain documentation. The return time for the corrected documents will be determined on a case by case basis, and will be communicated to teams. Failure to make the appropriate corrections in time may exclude the respective vehicle from the AV demonstration.</p>
A5.5	16	Delete A 5.5
A5.6	16	Delete A.5.6. In 2022, the Vehicle Status Video (VSV) is not required.
A5.7	16	<p>SES Approval Delete EFS Words.</p> <p>A separate SESA form is not required. Submit the SES as defined in the <i>International 2022 Formula SAE-I Rules</i> and the <i>Local Addendum to Formula SAE 2022 rules</i>.</p>

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A6 – GENERAL RULES

EFS Rule	Page	Changes and Clarifications
A6.1 – 6.12	18- 22	The EFS Rule A6.7.4, Page 19, is retained. Delete all other EFS A6 rules and comply with the requirements defined in the <i>International 2022 Formula SAE-I Rules</i> and the <i>Local Addendum to Formula SAE 2022 rules</i> .

DV – DRIVERLESS VEHICLES

EFS Rule	Page	Changes and Clarifications
T14.3	64	Data Logger Delete EFS Clauses and Add: An AV Data Logger will be provided by the officials and will be attached to the vehicle in order to proceed with the AV technical inspection. The data logger will be used during technical inspection to ensure appropriate monitoring of safety-critical signals. Further details relating to the local Data Logger will be made available to teams later in the year in the Event Handbook. Table DV1.3 in Appendix A-2, outlines the message definition of general AV data that must be monitored and made available during technical inspection. Further information regarding the interface is detailed in the FSG Handbook DE7.3
T14.4 T14.4.7	65 65	Remote Emergency System (RES) Delete the reference Clauses 7.4.2, 7.4.3, 7.4.4 and 7.4.12 in the FSG Handbook. Add the following clause; (NB; hardware specifications are identical to the FSG 7.4.2 requirements but do not require the software upgrade). The RES that has to be used for the competition is a GF2000i-codec/T53R98 combination from Gross-Funk GmbH11. <ul style="list-style-type: none"> • SIL3 (EN61508) certified • EMV certified • communication in 430 MHz to 440 MHz band • increased signal strength of 88 mW • 12 V to 24 V supply voltage (0.26 A @12 V) • 450 g, 173 mm × 113 mm × 35 mm • IP20 (receiver) / IP65 (sender) Further details regarding the selected RES may be found in the Formula Student Germany 2022 Competition Handbook DE7.4.

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T14.12	68	<p>Autonomous Missions</p> <p>The 2022 FSAE-A AV Demonstration will only include Trackdrive, EBS Test, Inspection and Manual driving. Delete EFS T14.12.1 and Add; The AS must at least implement the following missions:</p> <ul style="list-style-type: none"> - Trackdrive - EBS test - Inspection - Manual Driving
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IN – TECHNICAL INSEPECTION

EFS Rule	Page	Changes and Clarifications
IN1	98	<p>General Rules</p> <p>At the FSAE-A Event, vehicles must first successfully complete the relevant prerequisite mechanical, EV and/or ICE technical inspections prior to the Autonomous Vehicle Technical Inspection, which will be carried out per the AV Technical Inspection Checklist 2022 (Refer to SAE-A website). As per the EFS Rules, each vehicle must pass Autonomous System Inspection and EBS Test before it may participate in any driverless dynamic event.</p>

S – STATIC EVENTS

EFS Rule	Page	Changes and Clarifications
S1	107	<p>Business Plan Presentation Event</p> <p>In 2022, the AV demonstration will be a non-scored competition, however, AV teams may provide notice to the officials and develop and present a Business Plan for the purposes of practice and feedback.</p>
S2	108	<p>Cost and Manufacturing Event</p> <p>In 2022, there will be no cost event for the AV demonstration. As such, any document submissions that relate exclusively to the Cost Event will not be required. (Continued below)</p>

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S2 (Cont.d)	108	<p>Teams entering a joint vehicle in the Driven Event and the AV Demonstration will of course have to submit a Cost Report and be judged in the Driven FSAE-A Cost Event.</p> <p>The Cost Report must include the cost of all AV components which remain on the vehicle when it is driven in the standard Dynamic events.</p> <p>Only those components which are used in the AV form and which are removed from the vehicle when competing as a driven vehicle may be excluded from the Cost Report.</p>
S3	113	<p>Engineering Design Event</p> <p>Similar to the Business Plan Event, for 2022 while no score will be awarded, AV teams may provide notice to the officials and develop and present a Design Presentation at the Competition for the purposes of practice and feedback. No prior document submission (e.g. Detailed Design Report and video) other than the Autonomous Systems Design Report would be required.</p>

D – DYNAMIC EVENTS

FS Rule	Page	Changes and Clarifications
D1	116	<p>General</p> <p>Delete all EFS clauses and Add Note for FSAE-A 2022 AV Competition;</p> <p>The 2022 FSAE-A competition will have two dynamic events for AVs that have successfully completed the technical inspection process. Successful completion of the EBS test will enable the AV to participate in the autonomous Trackdrive demonstration.</p> <p>Refer to the <i>2022 FSAE-A Competition Handbook</i> for latest Event Timing</p>
D2.2.8	116	<p>Driving Under Power</p> <p>Ignore all EFS D1 and D2 clauses except for Clause D2.2.8 which will apply at the FSAE-A Competition.</p>
D2.3.1	117	<p>Practice Track</p> <p>The availability of a unique AV practice track is not guaranteed.</p>

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D2.4	118	<p>Cones and Markings Delete EFS words and Add;</p> <p>The markings of all dynamic events will have the following characteristics:</p> <ul style="list-style-type: none"> - The track is marked with cones. - The left borders of the track are marked with small blue cones. - The right borders of the track are marked with small yellow cones. - Exit and entry lanes are marked with small orange cones. - Large orange cones will be placed at the start/finish lines. - The maximum distance between two cones in driving direction is 5 m. In corners, the distance between the cones may be smaller for a better indication. <p>The cones used at the competition are equal to the cones listed in Table D2.4 in Appendix A-3 below.</p> <ul style="list-style-type: none"> - The start, finish and timekeeping lines as well as keep out zones around the timekeeping equipment may be marked with paint. - Additionally for skid pad and Trackdrive, track limit lines on either side of the track and entry/exit lanes may be marked with paint. - There are no track limit lines for acceleration and Emergency Brake System (EBS)-test. - The lines may not be perfectly and continuously drawn. - There may be further markings, to those mentioned above, that are not part of the track (e.g. markings, including cone position markings, lines from other events or different coloured surfaces, etc.) on or close to the track which will not be removed by the officials. - There may be (stacked) spare cones standing at the trackside at a distinguishable distance. - No special artificial landmarks are provided by officials. The team must not place additional landmarks on the track or inside the dynamic area. <p>No map data is provided by the officials.</p>
D3	119	<p>WEATHER CONDITIONS Delete EFS clauses The rules per the FSAE 2022 Rules in Clauses D.5 and D.6 apply at the FSAE-A 2022 Event.</p>
D4	119	<p>Skidpad Event Delete D4. The 2022 AV Demonstration Event will not include a skidpad event.</p>

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D5	122	Acceleration Event Delete D5. The 2022 AV Demonstration Event will not include an acceleration event.
D6	124	Autocross Event Delete D6. The 2022 AV Demonstration Event will not include an autocross event.
D7	125	Endurance and Efficiency Delete D7 The 2022 AV Demonstration Event will not include an endurance event, however this is replaced with the AV Trackdrive.
D8.1	130	Trackdrive and Efficiency Event Delete EFS Words and Add; The main dynamic event in the 2022 AV Demonstration will be the Trackdrive event. The Trackdrive will occur at the Skidpan area at Winton Motor Raceway, and the exact location of the track will be published in the <i>2022 FSAE-A Competition Handbook</i> . In general, the trackdrive layout will have the following features: <ul style="list-style-type: none"> - Straights: No longer than 100m - Constant Turns: Up to 50m diameter - Hairpin Turns: Minimum of 9m outside diameter (of the turn) - Miscellaneous: Chicanes, multiple turns, decreasing radius turns, etc. - The minimum track width is 3m
D8.2	130	Trackdrive Procedure
D8.2.1	130	Delete EFS word and Add: The starting order will be based on the order of completion of all technical inspection events, including the EBS test.
D8.2.2 – D8.2.8	130 – 131	While the track procedure will be generally based on D8.2, complete details for the FSAE-A Demonstration event will be included in the FSAE-A 2022 Event Handbook
D8.3	131	Trackdrive Scoring Delete EFS words. The Trackdrive event will not be scored.

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APPENDIX PDA - 1
Action Deadlines for 2022 Formula SAE Australasia

All submissions must be uploaded via the online Formula SAE-A 2022 Document Submissions Google Form by 5:00 PM (Melbourne local time) on the defined date. Teams should check and allow for time zone and Summer/Standard/Winter time differences.

The US Rules for late receipt apply, except where otherwise noted earlier in this Addendum. Forms and templates and details of their required format can be downloaded from the SAE-A website at www.saea.com.au.

All electronic submissions are to be uploaded by the Team Leader to the online Formula SAE-A 2021 Document Submissions Google Form at https://docs.google.com/forms/d/e/1FAIpQLSdgSmnzjiDK9jCTcGy_YS9M9_hhXZiKUXsmhZJcXIsEplhQ-w/viewform using a University or official team email address. The Team Leader email addresses must be unique for Universities with multiple entries. An email acknowledging receipt will be provided by the Google Forms site. Use the included edit link to submit subsequent documents.

Dates for Autonomous Vehicle teams and Submissions are common with other Dates as shown for the applicable powertrain type. Where unique AV submissions/documentation are required they are shown as a separate line item.

Submissions must adhere to standard file naming and file format listed in Table DR-1.

Other than what is specified for on-site registration, no hard copy submissions will be required.

Date	Milestone/Deadline	Submission Method	Vehicle Type	Event Type
18 Apr	Registration Open for all teams. Registration and payment may be submitted.	Electronic	EV & IC	Dynamic & Static
27 May	Electronic Throttle Control (ETC) Deadline for Notice of Intent submission	Electronic	IC	Dynamic
2 Aug	All Teams: (i) Team Registrations Close (ii) Entry Fees deadline	-	EV & IC	Dynamic & Static
9 Sep	Electrical systems officer and electrical systems advisor forms deadline	Electronic	EV	Dynamic
9 Sep	ESF and FMEA deadline	Electronic	EV	Dynamic & Static
9 Sep	Autonomous Systems Form	Electronic	EV (AV)	Dynamic & Static
9 Sep	Rationale/Evidence for non-fitment of PDOC	Electronic	IC	Dynamic & Static
9 Sep	Electronic Throttle Control FMEA deadline	Electronic	IC	Dynamic & Static
9 Sep	Autonomous Vehicle Operation Diagram	Electronic	EV & IC (AV)	Dynamic & Static
9 Sep	Autonomous Vehicle Wiring Diagram	Electronic	EV & IC (AV)	Dynamic & Static

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9 Sep	Autonomous Vehicle Schematic Diagrams	Electronic	EV & IC (AV)	Dynamic & Static
23 Sep	Structural Equivalency Spreadsheet deadline including Integral IAD report	Electronic	EV & IC	Dynamic & Static
23 Sep	Autonomous Vehicle Mechanical Parts	Electronic	EV & IC (AV)	Dynamic & Static
23 Sep	Autonomous Hydraulic/Pneumatic Systems	Electronic	EV & IC (AV)	Dynamic & Static
7 Oct	Design Report, Specifications Sheet and Video deadline	Electronic	EV & IC	Static
7 Oct	Autonomous Systems Design Report	Electronic	EV & IC (AV)	Static
7 Oct	Cost Report and eBOM deadline	Electronic	EV & IC	Static
7 Oct	AV teams notice of entry in Static Event(s)	Electronic Word Doc.	EV & IC	Static
11 Oct	On Site Cost Scenario or Task Advised to Teams	Email and Website	EV & IC	Static
25 Oct	Final team member list deadline	Electronic	EV & IC	Dynamic & Static
28 Oct	Individual team member fees deadline (All teams).	-	EV & IC	Dynamic & Static
28 Oct	Motorsport Australia license application submission deadline	Electronic	EV & IC	Dynamic
28 Oct	Declaration of planned hazardous materials and MSDS deadline.	Electronic	EV & IC	Dynamic
4 Nov	Conversion Process and component detail for any proposed dual entry EV - AV vehicle.	Electronic	EV (AV)	Dynamic
18 Nov	Nomination of Focus Cost System(s) to Teams	Email and Website	EV & IC	Dynamic
25 Nov	Tech Inspection Checklist including notice of ETC approval; Egress Times List.	Electronic	EV & IC	Dynamic
25 Nov	Electrical Inspection Checklist deadline	Electronic	EV	Dynamic
25 Nov	Autonomous Vehicle Inspection Checklist	Electronic	EV & IC (AV)	Dynamic
08 Dec	Declaration of final hazardous materials and MSDS deadline; copy of Tech Inspection checklists; copy of Egress Times List.	Hand Deliver at Site Registration	EV & IC	Dynamic
08-12 Dec	Formula SAE-Australasia Competition	-	EV & IC	Dynamic

Rule and Cost enquiries are to be submitted online via the process outlined on the SAE-A website.

http://www.saea.com.au/Rules_Enquiry_2022

General enquiries may be submitted via email to formulasae@sae-a.com.au

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Appendix PDA-2

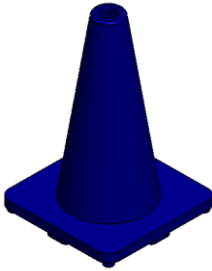

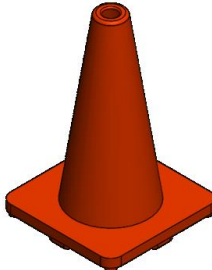
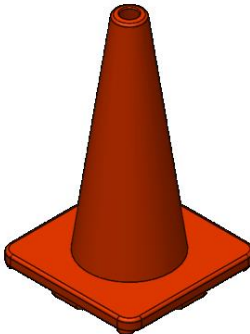
Table DV 1.3; Message definition of logged general DV data

CAN-ID	Name	Length	Format	Unit	Scale
0x500	DV driving dynamics 1	8 B			
	Speed_actual	bit 0-7	unsigned	km/h	
	Speed_target	bit 8-15	unsigned	km/h	
	Steering_angle_actual	bit 16-23	signed	°	0.5
	Steering_angle_target	bit 24-31	signed	°	0.5
	Brake_hydr_actual	bit 32-39	unsigned	%	
	Brake_hydr_target	bit 40-47	unsigned	%	
	Motor_moment_actual	bit 48-55	signed	%	
Motor_moment_target	bit 56-63	signed	%		
0x501	DV driving dynamics 2	6 B			
	Acceleration longitudinal	bit 0-15	signed	m/s ²	$\frac{1}{512}$
	Acceleration lateral	bit 16-31	signed	m/s ²	$\frac{1}{512}$
	Yaw rate	bit 32-47	signed	°/s	$\frac{1}{128}$
0x502	DV system status	5 B			
	AS_state_off		1		
	AS_state_ready		2		
	AS_state_driving	bit 0-2	3		
	AS_state_emergency_brake		4		
	AS_state_finish		5		
	EBS_state_unavailable		1		
	EBS_state_armed	bit 3-4	2		
	EBS_state_activated		3		
	AMI_state_acceleration		1		
	AMI_state_skidpad		2		
	AMI_state_trackdrive	bit 5-7	3		
	AMI_state_braketest		4		
	AMI_state_inspection		5		
	AMI_state_autocross		6		
	Steering_state	bit 8	bool		
	Service_brake_state_disengaged		1		
	Service_brake_state_engaged	bit 9-10	2		
	Service_brake_state_available		3		
	Lap_counter	bit 11-14	unsigned		
Cones_count_actual	bit 15-22	unsigned			
Cones_count_all	bit 23-39	unsigned			

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Appendix PDA-3

Table D2.5 - Cone Specifications for the 2022 AV Class Demonstration Event

Cone Type ¹	Dimensions	Picture
Small Blue Cone (Plain) https://grabcad.com/library/300mm-blue-road-cone-1	210mmx210mmx300mm	
Small Yellow Cone (Plain) https://grabcad.com/library/300mm-yellow-road-cone-1	210mmx210mmx300mm	
Small Orange Cone (Plain) https://grabcad.com/library/300mm-orange-road-cone-1	210mmx210mmx300mm	
Large Orange Cone (Plain) https://grabcad.com/library/450mm-orange-road-cone-2	270mmx270mmx450mm	

Cones are locally available from <https://colouredtrafficcones.com.au/>