CAM PROFILE

Colophon

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Contents

[1 Introduction—3](#_Toc485287811)

[1.1 Purpose of this Document—3](#_Toc485287812)

[1.2 Cooperative Awareness Messages (CAM)—3](#_Toc485287813)

[1.3 Assumptions—3](#_Toc485287814)

[1.4 Legend—3](#_Toc485287815)

[1.5 Document history—4](#_Toc485287816)

[2 Cooperative Awareness Message—5](#_Toc485287817)

[Annex A: Members subWG NL profile—18](#_Toc485287818)

1. Introduction
   1. Purpose of this Document

This document provides the Dutch Profile for the Cooperative Awareness Messages (CAM). It offers an interpretation of data frames/elements and describes the use of them as extension to the standards.

* 1. Cooperative Awareness Messages (CAM)

Cooperative Awareness Messages (CAMs) are messages exchanged in the ITS network between ITS-stations to create and maintain awareness and to support cooperative performance of vehicles using the road network. A CAM contains status and attribute information of the originating ITS-S. The content varies depending on the type of the ITS-S. For vehicle ITS-Ss the status information includes time, position, motion state, activated systems, etc. and the attribute information includes data about the dimensions, vehicle type and role in the road traffic, etc. On reception of a CAM the receiving ITS-S becomes aware of the presence, type, and status of the originating ITS-S. The received information can be used by the receiving ITS-S to support several ITS applications.

* 1. Assumptions

The following standards have been used to prepare this profile:

* ETSI EN 302 637-2 V1.3.2 (2014-11), Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service
* ETSI TS102 894-2, Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary, V1.2.1 (2014-09)
  1. Legend

Chapter 2 contains the actual profile describing how the data frames (DFs) and data elements (DEs) shall be used for the implementation of the CAM.

The description of the DFs and DEs can be found in aforementioned standards. The description of the DEs and DFs in this document build upon the descriptions in these standards.

The font style of the name of DEs and DFs indicates the status as defined in the standards:

* **Bold**: required by the standard;
* *Italic*: these are optional in the standard;
* Underlined: one of these can be chosen (OR);

The status in the profile is indicated in a separate column by means of one of the following labels:

* Mandatory. This DF or DE is mandatory in the standard and is thus always provided.
* Profiled. This DF or DE is mandatory in the profile although optional in the standard OR mandatory the standard and profile but not used. It is therefore assumed that this DF or DE will always be provided OR set to unavailable.
* Conditional. This DF or DE is mandatory in specific conditions and not used in other conditions. The conditions are provided in the profile.
* Optional. This DF or DE is optional in the standard as well as in the profile.
* Used. This DF or DE is a choice in the standard and used in the profile. It is therefore assumed that this DF or DE can be provided.
* Not used. This DF or DE is optional or a choice in the standard but not used in the profile. The response to the use of this DF or DE is therefore not guaranteed.
* Future use. This DF or DE is not relevant for use cases currently in scope and therefore not profiled in the current version of the profile.
* Bold. Applies to attributes in an enumeration or bitstring and indicates the attribute shall be assigned if applicable. All non-bold attributes are optional.
  1. Document history

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| --- | --- | --- |
| **Version** | **Date** | **Changes** |
| 0.1 | 26-04-2017 | Initial version |
| 0.2 | 12-05-2017 | Version with new comments, input WG meeting 12th of May |
| 0.3 | 07-06-2017 | Version with new comments, input WG meeting 12th of June |
| 1.0 | 15-06-2017 | Final version for broader review |
| 1.2 | 29-06-2017 | Final revised version for approval |

1. Cooperative Awareness Message

| Standard | | | | Profile | | |
| --- | --- | --- | --- | --- | --- | --- |
| Level | Field | Meaning | | Status | Content | Value |
| **Level 0: CAM** | | | | | | |
| 0.1 | **header [ItsPduHeader]** | ITS PDU header of the CAM. | | Mandatory | - | See level 1 |
| 0.2 | **cam [CoopAwareness]** | CAM payload. | | Mandatory | - | See level 2 |
|  | | | | | | |
| **Level 1: ItsPduHeader (ETSI TS 102 894-2 V1.2.1)** | | | | | | |
| 1.1 | **protocolVersion** | Version of the protocol. | | Fixed | Current version is 1. | Set to 1 |
| 1.2 | **messageID** | Indicates the type of message. | | Fixed | Examples are denm(1), cam(2), spat(4) etc. | Set to 2 |
| 1.3 | **stationID**  **[StationID]** | This is the ID of the station broadcasting the message. | | Mandatory | The stationID must be identical to the stationID of the vehicle. The stationID is subject to change at intervals (pseudonym), but may not change while passing an intersection (see e.g. SRM profile). | Set by application. |
|  |  |  | |  |  |  |
| **Level 2: CoopAwareness** | | | | | | |
| 2.1 | **generationDeltaTime [Generation-DeltaTime]** | Time corresponding to the time of the reference position in the CAM, considered as time of the CAM generation. | | Mandatory | - | Set by application |
| 2.2 | **camParameters [CamParameters]** | The sequence of CAM mandatory and optional containers. Other containers may be added in the future. | | Mandatory | - | See level 3 |
|  | | | | | | |
|  | | | | | | |
| **Level 3: CamParameters** | | | | | | |
| 3.1 | **basicContainer [BasicContainer]** | The mandatory basic container of CAM. | | Mandatory | - | See level 4 |
| 3.2 | **highFrequency-Container [HighFrequency-Container]** | The mandatory high frequency container of CAM. Other types of high frequency container might be added in the future. | | Mandatory | - | See level 5 |
| 3.3 | *lowFrequencyContainer [LowFrequency-Container]* | The low frequency container of CAM. Within the scope of the present document, only the vehicle low frequency container is defined.  Other types of low frequency container (e.g. road side ITS-S) might be added in the future. | | Profiled | Mandatory for vehicle ITS stations, then the vehicle low frequency container is mandatory. | See level 6 |
| 3.4 | *specialVehicleContainer [SpecialVehicle-Container]* | The special container of the CAM shall be present as defined in clause 6.1.3. | | Optional | As appropriate, subject to the vehicleRole. | See level 7 |
|  | | | | | | |
| **Level 4: BasicContainer** | | | | | | |
| 4.1 | **stationType [StationType]** | Station type of the originating ITS-S. | | Mandatory | This DE can be 0 or 4 – 10. Other values indicate vehicles that are not allowed on the highway. | Set by application |
| 4.2 | **referencePosition [ReferencePosition]** | Position and position accuracy measured at the reference point of the originating ITS-S. |  | Mandatory |  |  |
| **Latitude** | Mandatory | - | Set by application |
| **Longitude** | Mandatory | - | Set by application |
| **positionConfidenceElipse**  The positionConfidence-Ellipse provides the accuracy of the measured position with the 95 % confidence level. Otherwise, the position-ConfidenceEllipse shall be set to unavailable. | Optional | If available, e.g. if GPS provides HDOP (horizontal dilution of precision). | See level 18 |
| **Altitude** | Profiled | Mandatory but not used in profile therefore set to unavailable. Accuracy of altitude measurement typically is poor. | See level 19 |
|  | | | | | | |
| **Level 5: HighFrequencyContainer** | | | | | | |
| 5.1 | basicVehicleContainer-HighFrequency [BasicVehicleContainer-HighFrequency] | The mandatory high frequency container of the CAM when the originating ITS-S is of the type vehicle ITS-S. | | Used | Subject to ITS station type. | See level 8 |
| 5.2 | rsuContainer-HighFrequency [RSUContainer-HighFrequency] | The mandatory high frequency container of CAM when the type of the originating ITS-S is RSU ITS-S. | | Used | Subject to ITS station type. Since data elements within are mostly unused (see below), this DE is typically not used. | See level 17 |
|  | | | | | | |
| **Level 6: LowFrequencyContainer** | | | | | | |
| 6.1 | basicVehicleContainer-LowFrequency [BasicVehicleContainer-LowFrequency] | The low frequency container of the CAM when the originating ITS-S is of the type vehicle ITS-S. | | Used | It shall be present as defined in 3.3, therefore mandatory for vehicle ITS stations. | See level 9 |
|  | | | | | | |
| **Level 7: SpecialVehicleContainer** | | | | | | |
| 7.1 | publicTransport-Container [PublicTransport-Container] | A container of the CAM included in the special vehicle container. | | Used | If the DE vehicleRole is set to publicTransport(1) this container shall be present. | See level 10 |
| 7.2 | specialTransport-Container [SpecialTransport-Container] | A container of the CAM included in the special vehicle container. | | Used | If the DE vehicleRole is set to specialTransport(2) this container shall be present. | See level 11 |
| 7.3 | dangerousGoods-Container [DangerousGoods-Container] | A container of the CAM included in the special vehicle container. | | Used | If the DE vehicleRole is set to dangerousGoods(3) this container shall be present. | See level 12 |
| 7.4 | roadWorksContainer-Basic [RoadWorksContainer-Basic] | A container of the CAM included in the special vehicle container. | | Used | If the DE vehicleRole is set to roadWork(4) this container shall be present. | See level 13 |
| 7.5 | rescueContainer [RescueContainer] | A container of the CAM included in the special vehicle container. | | Used | If the DE vehicleRole is set to rescue(5) his container shall be present. | See level 14 |
| 7.6 | emergencyContainer [EmergencyContainer] | A container of the CAM included in the special vehicle container. | | Used | If the DE vehicleRole is set to emergency(6) this container shall be present. | See level 15 |
| 7.7 | safetyCarContainer [SafetyCarContainer] | A container of the CAM included in the special vehicle container. | | Used | If the DE vehicleRole is set to safetyCar(7) this container shall be present. | See level 16 |
|  | | | | | | |
| **Level 8: BasicVehicleContainerHighFrequency** | | | | | | |
| 8.1 | **heading [Heading]** | Heading and heading accuracy of the vehicle movement of the originating ITS-S with regards to the true north. |  | Mandatory |  |  |
| **headingValue**  The (compass) direction of the vehicle, in 1/10th of a degree. | Mandatory | - | Set by application |
| **headingConfidence**  The heading accuracy provided in the DE headingConfidence value shall provide the accuracy of the measured vehicle heading with a confidence level of 95 %. | Profiled | Mandatory but not used in profile therefore set to unavailable = 127 | 127 |
| 8.2 | **speed [Speed]** | Driving speed and speed accuracy of the originating ITS-S. |  | Mandatory |  |  |
| **speedValue**  Speed of the vehicle in cm/s. | Mandatory |  | Set by application |
| **speedConfidence**  The speed accuracy provided in the DE speedConfidence shall provide the accuracy of the speed value with a confidence level of 95 %. Otherwise, the speed-Confidence shall be set to unavailable. | Profiled | Mandatory but not used in profile therefore set to unavailable = 127 | 127 |
| 8.3 | **driveDirection [DriveDirection]** | The direction the vehicle is travelling in. | | Mandatory | forward(0), backward(1) or unavailable(2). | Set by application |
| 8.4 | **vehicleLength [VehicleLength]** | Vehicle length of the vehicle ITS-S that originates  the CAM. |  | Mandatory |  |  |
| **vehicleLenghtValue**  Vehicle length of the vehicle ITS-S that originates the CAM. | Mandatory | Length of the vehicle in steps of 10 cm. 1 == 10cm. | Set by application |
| **vehicleLenghtConfidence-Indication**  vehicleLengthConfidenceIndication: indication of whether trailer is detected to be present and whether the length of the trailer is known. | Mandatory | Recommended to provide if known. | Set by application |
| 8.5 | **vehicleWidth [VehicleWidth]** | Vehicle width, measured of the vehicle ITS-S that originates the CAM, including side mirrors. | | Mandatory | Mandatory for special vehicles with extra width. Otherwise set to unavailable. | Set by application |
| 8.6 | **longitudinal-Acceleration [Longitudinal-Acceleration]** | Vehicle longitudinal acceleration of the originating ITS-S in the centre of the mass  of the empty vehicle. |  | Mandatory |  |  |
| **longitudinalAcceleration-Value**  The longitudinal (forward / backward) acceleration of the vehicle in steps of 0.1 m/s2. | Profiled | Mandatory but not used in profile therefore set to unavailable = 161 | 161 |
| **longitudinalAcceleration-Confidence**  The accuracy value with the confidence level of 95 %. Otherwise, the longitudinalAcceleration-Confidence shall be set to unavailable. | Profiled | Mandatory but not used in profile therefore set to unavailable = 102 | 102 |
| 8.7 | **curvature [Curvature]** | The curvature of the vehicle trajectory. |  | Profiled | Mandatory but not used in profile therefore set to unavailable. | - |
| **curvatureValue**  curvatureValue denoted as inverse of the vehicle current curve radius and the turning direction of the curve with regards to the driving | Profiled | Mandatory but not used in profile therefore set to unavailable = 30001 | 30001 |
| **curvatureConfidence**  curvatureConfidence denoted as the accuracy of the provided curvatureValue for a confidence level of 95 %. | Profiled | Mandatory but not used in profile therefore set to unavailable = 7 | 7 |
| 8.8 | **curvature-CalculationMode [Curvature-CalculationMode]** | The calculation mode for the curvature.  Flag indicating whether vehicle yaw-rate is used in the calculation of the curvature of the vehicle ITS-S that originates the CAM. | | Profiled | Mandatory but not used in profile therefore set to unavailable = 2 | 2 |
| 8.9 | **yawRate [YawRate]** | The rate the vehicle is spinning around its centre of mass. |  | Profiled | Mandatory but not used in profile therefore set to unavailable. | - |
| **yawRateValue**  yawRateValue denotes the vehicle rotation around the centre of mass of the empty vehicle. The leading sign denotes the direction of rotation. The value is negative if the motion is clockwise when viewing from the top. | Profiled | Mandatory but not used in profile therefore set to unavailable = 32767 | 32767 |
| **yawRateConfidence**  yawRateConfidence denotes the accuracy for the 95 % confidence level for the measured yawRateValue. Otherwise, the value of yawRateConfidence shall be set to unavailable. | Profiled | Mandatory but not used in profile therefore set to unavailable = 8 | 8 |
| 8.10 | *accelerationControl [AccelerationControl]* | Current status of the vehicle mechanisms controlling the longitudinal movement of the vehicle ITS-S (e.g. brake pedal, gas pedal, etc. engaged) that originates the CAM as specified in ETSI TS 102 894-2 [2]. | | Not used | - | - |
| 8.11 | *lanePosition [LanePosition]* | The DE lanePosition of the referencePosition of a vehicle, counted from the outside border of the road, in the direction of the traffic flow. | | Not used | - | - |
| 8.12 | *steeringWheelAngle [SteeringWheelAngle]* | This DF includes the steering wheel angle and accuracy as measured at the vehicle ITS-S that originates the CAM. |  | Not used | - | - |
| steeringWheelAngleValue  steeringWheelAngleValue denotes steering wheel angle as measured at  the vehicle ITS-S that originates the CAM. | Not used | - | - |
| steeringWheelAngle-Confidence  steeringWheelAngle-Confidence denotes the accuracy of the measured steeringWheelAngleValue for a confidence level of 95 %. Otherwise, the value of steeringWheel-AngleValue shall be set to unavailable. | Not used | - | - |
| 8.13 | *lateralAcceleration [LateralAcceleration]* | Vehicle lateral acceleration of the originating ITS-S in the centre of the mass of the empty vehicle. | | Not used | - | - |
| 8.14 | *verticalAcceleration [VerticalAcceleration]* | Vertical Acceleration of the originating ITS-S in the centre of the mass of the empty vehicle. | | Not used | - | - |
| 8.15 | *performanceClass [PerformanceClass]* | The DE performanceClass characterizes the maximum age of the CAM data elements with regard to the generationDeltaTime. | | Not used | - | - |
| 8.16 | *cenDsrcTollingZone [CenDsrcTollingZone]* | Information about the position of a CEN DSRC Tolling Station operating in the 5,8 GHz frequency band. If this information is provided by vehicle ITS-S, a receiving vehicle ITS-S is prepared to adopt mitigation techniques when being in the vicinity of CEN DSRC tolling stations. | | Not used | - | - |
|  | | | | | | |
| **Level 9: BasicVehicleContainerLowFrequency** | | | | | | |
| 9.1 | **vehicleRole [VehicleRole]** | The role of the vehicle (e.g. public transport). | | Mandatory |  | Set by application |
| 9.2 | **exteriorLights [ExteriorLights]** | This DE is a sequence of bits (BIT STRING) of size 8. Each bit holds the status of the exterior light switches of a vehicle (e.g. fogLightOn, leftTurnSignalOn, etc.). | | Mandatory | Turn signal are set based on navigation system. If not signals are set, the vehicle is expected to follow the straight movement. | Set by application |
| 9.3 | **pathHistory [PathHistory]** | This DF can hold up to 40 points (pathPosition) of where the vehicle has been, optionally with an accompanying timestamp (pathDeltaTime). The timestamp would allow for speed calculation between the points. | | Profiled | Mandatory but not used in profile, therefore only 1 pathPosition will be provided which is the current position. | Set by application |
|  | | | | | | |
| **Level 10: PublicTransportContainer** | | | | | | |
| 10.1 | **embarkationStatus [EmbarkationStatus]** | This DE indicates whether the passenger embarkation is currently ongoing. | | Mandatory | The presentation and data setting rules shall be as specified in ETSI TS 102 894-2 [2] EmbarkationStatus. It shall be set to TRUE when the embarkation is ongoing. Otherwise, it shall be set to FALSE. | Set by application |
| 10.2 | *ptActivation [PtActivation]* | This DF is used by public transport vehicles for controlling traffic lights, barriers, bollards, etc. |  | Mandatory | - | - |
| **PtActivationType**  This DE indicates a certain coding type of the PtActivationData data.  • 0: undefined coding type,  • 1: coding of PtActivationData conform to VDV recommendation 420 [i.8],  • 2: coding of PtActivationData based on VDV recommendation 420 [i.8]. | Mandatory | 3: coding of PtActivationData based on Talking Traffic recommendations. | 3 |
| **PtActivationData**  DE used for various tasks in the public transportation environment, especially for controlling traffic signal systems to prioritize and speed up public transportation in urban area (e.g. intersection "bottlenecks"). | Mandatory | Defined as follows (all bits unsigned; ‘big endian format (most significant octet first):   |  |  |  | | --- | --- | --- | | Octet # | Field name | Size | | 0,1 | Line nr PT | 16 bits | | 2,3 | Vehicle ID | 16 bits | | 4,5 | Block nr | 16 bits | | 6,7 | Journey nr | 16 bits | | 8,9 | Support journey nr | 16 bits | | 10 | Company nr | 8 bits | | 11,12 | Occupancy | 16 bits | | Set by application |
|  | | | | | | |
| **Level 11: SpecialTransportContainer** | | | | | | |
| 11.1 | **specialTransportType [SpecialTransport-Type]** | This DE indicates whether the originating ITS-S is mounted on a special transport vehicle with heavy or oversized load or both. | | Mandatory | Mandatory if the container is used. | Set by application |
| 11.2 | **lightBarSirenInUse [LightBarSirenInUse]** | This DE indicates whether light-bar or a siren is in use by the vehicle originating the CAM. | | Mandatory | Mandatory if the container is used. | Set by application |
|  | | | | | | |
| **Level 12: DangerousGoodsContainer** | | | | | | |
| 12.1 | **dangerousGoods-Basic [Dangerous-GoodsBasic]** | This DE identifies the type of the dangerous goods transported by the vehicle that originates the CAM. | | Mandatory | Mandatory if the container is used. | Set by application |
|  | | | | | | |
| **Level 13: RoadWorksContainerBasic** | | | | | | |
| 13.1 | *roadworksSubCause-Code [RoadworksSubCause-Code]* | This DE is included in case the originating ITS-S is mounted to a vehicle ITS-S participating to roadwork. It provides information on the type of roadwork that it is currently undertaking. | | Not used | It is recommended to include the information in a DENM message. | - |
| 13.2 | **lightBarSirenInUse [LightBarSirenInUse]** | This DE indicates whether light-bar or a siren is in use by the vehicle originating the CAM. | | Mandatory | Mandatory if the container is used. | Set by application |
| 13.3 | *closedLanes [ClosedLanes]* | This DE provides information about the opening/closure status of the lanes ahead. Lanes are counted from the outside boarder of the road. | | Not used | It is recommended to include the information in a DENM message. | - |
|  | | | | | | |
| **Level 14: RescueContainer** | | | | | | |
| 14.1 | **lightBarSirenInUse [LightBarSirenInUse]** | This DE indicates whether light-bar or a siren is in use by the vehicle originating the CAM. | | Mandatory | Mandatory if the container is used. | Set by application |
|  | | | | | | |
| **Level 15: EmergencyContainer** | | | | | | |
| 15.1 | **lightBarSirenInUse [LightBarSirenInUse]** | This DE indicates whether light-bar or a siren is in use by the vehicle originating the CAM. | | Mandatory | Mandatory if the container is used. | Set by application |
| 15.2 | *incidentIndication [CauseCode]* |  | | Not used | It is recommended to include the information in a DENM message. | Set by application |
| 15.3 | *emergencyPriority [EmergencyPriority]* | Right of way indicator of the vehicle ITS-S that originates the CAM PDU. It shall be originated by authorized vehicles only, e.g. ambulance, police, etc. | | Not used | It is recommended to include the information in a DENM message. | Set by application |

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| **Level 16: SafetyCarContainer** | | | | | |
| 16.1 | **lightBarSirenInUse [LightBarSirenInUse]** | This DE indicates whether light-bar or a siren is in use by the vehicle originating the CAM. | Mandatory | Mandatory if the container is used. | Set by application |
| 16.2 | *incidentIndication [CauseCode]* | This DE describes the event type of the emergency or safety mission. | Not used | - | - |
| 16.3 | *trafficRule [TrafficRule]* | This DE indicates whether vehicles are allowed to overtake a safety car that is originating this CAM. | Optional | May be used by road inspectors. | Set by application |
| 16.4 | *speedLimit [SpeedLimit]* | This DE indicates whether a speed limit is applied to vehicles following the safety car. | Optional | May be used by road inspectors. | Set by application |
|  | | | | | |
| **Level 17: RSUContainerHighFrequency** | | | | | |
| 17.1 | *protected-Communication-ZonesRSU [Protected-Communication-ZonesRSU]* | Information about position of a CEN DSRC Tolling Station operating in the 5,8 GHz frequency band. If this information is provided by RSUs a receiving vehicle ITS-S is prepared to adopt mitigation techniques when being in the vicinity of CEN DSRC tolling stations. | Not used | Out of scope for Dutch use cases. | - |
|  |  |  |  |  |  |
| **Level 18: positionConfidenceEllipse 🡪 PosConfidenceEllipse** | | | | | |
| 18.1 | **semiMajorConfidence**  **[SemiAxisLength]** | semiMajorConfidence: half of length of the major axis, i.e. distance between the centre point and major axis point of the position accuracy ellipse. | Optional | Unavailable = 4095 | Set by application |
| 18.2 | **semiMinorConfidence**  **[SemiAxisLength]** | semiMinorConfidence: half of length of the minor axis, i.e. distance between the centre point and minor axis point of the position accuracy ellipse. | Optional | Unavailable = 4095 | Set by application |
| 18.3 | **semiMajorOrientation**  **[HeadingValue]** | semiMajorOrientation: orientation direction of the ellipse major axis of the position accuracy ellipse with regards to the WGS84 north. | Optional | Unavailable = 3601 | Set by application |
|  |  |  |  |  |  |
| **Level 19: altitude 🡪 Altitude** | | | | | |
| 19.1 | **altitudeValue**  **[AltitudeValue]** | Altitude of a geographical point. | Not used | Unavailable = 800001 | 800001 |
| 19.2 | **altitudeConfidence**  **[AltitudeConfidence]** | Accuracy of the reported altitudeValue within a specific  confidence level. | Not used | Unavailable = 15 | 15 |

Annex A: Members subWG NL profile

Jaap Vreeswijk - MAPtm

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Peter Luns – Siemens

Eddy Verhoeven – Siemens

Peter Smit – Swarco

Jaap Zee – Swarco

Kartik Mundaragi Shivakumar – RHDHV

Klaas-Jan op den Kelder – RHDHV

Wannes de Smet – BeMobile

Arie Schreuders – Sweco

Bram Schiltmans – RWS