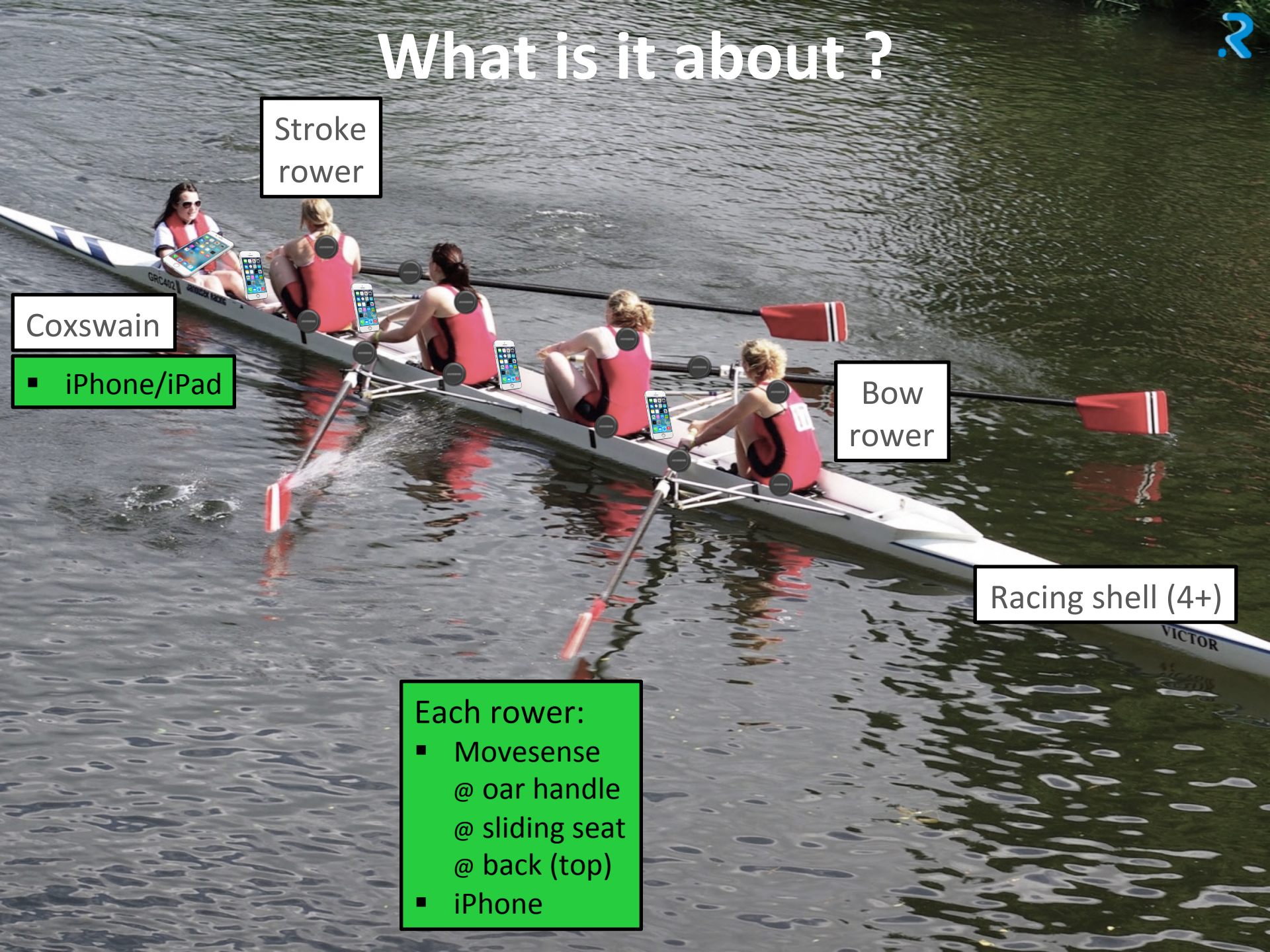
.Rowin'sense

Rowing Instrumentation for Coaches & Rowers to Detect & Quantify Stroke & Timing Flaws

Martin Ottow & Klaas Mussche &

KAASA SOLUTION

What is it about ?



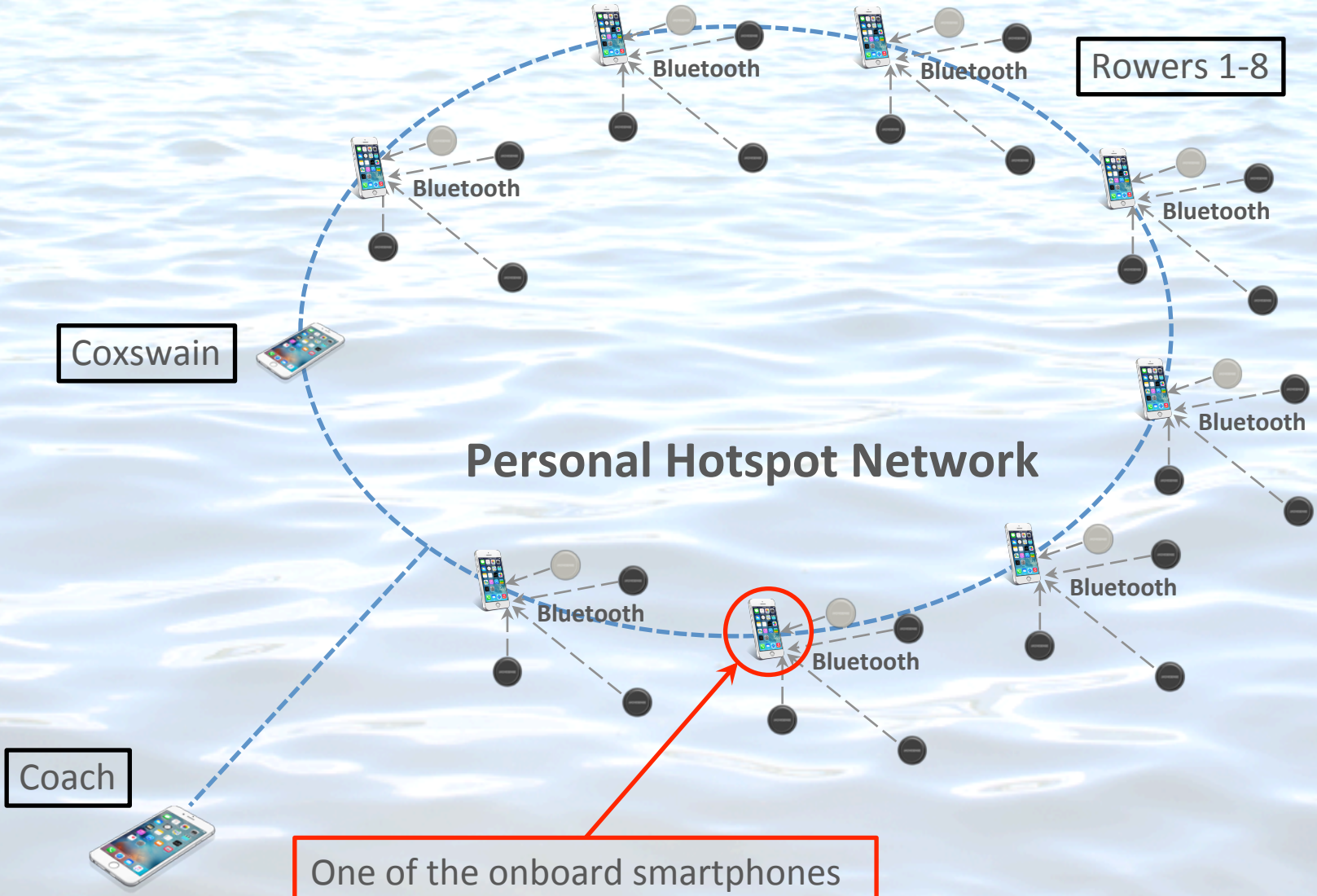
. . . and . . .

Coach

iPhone or iPad

PC or laptop for post-workout off-line analysis

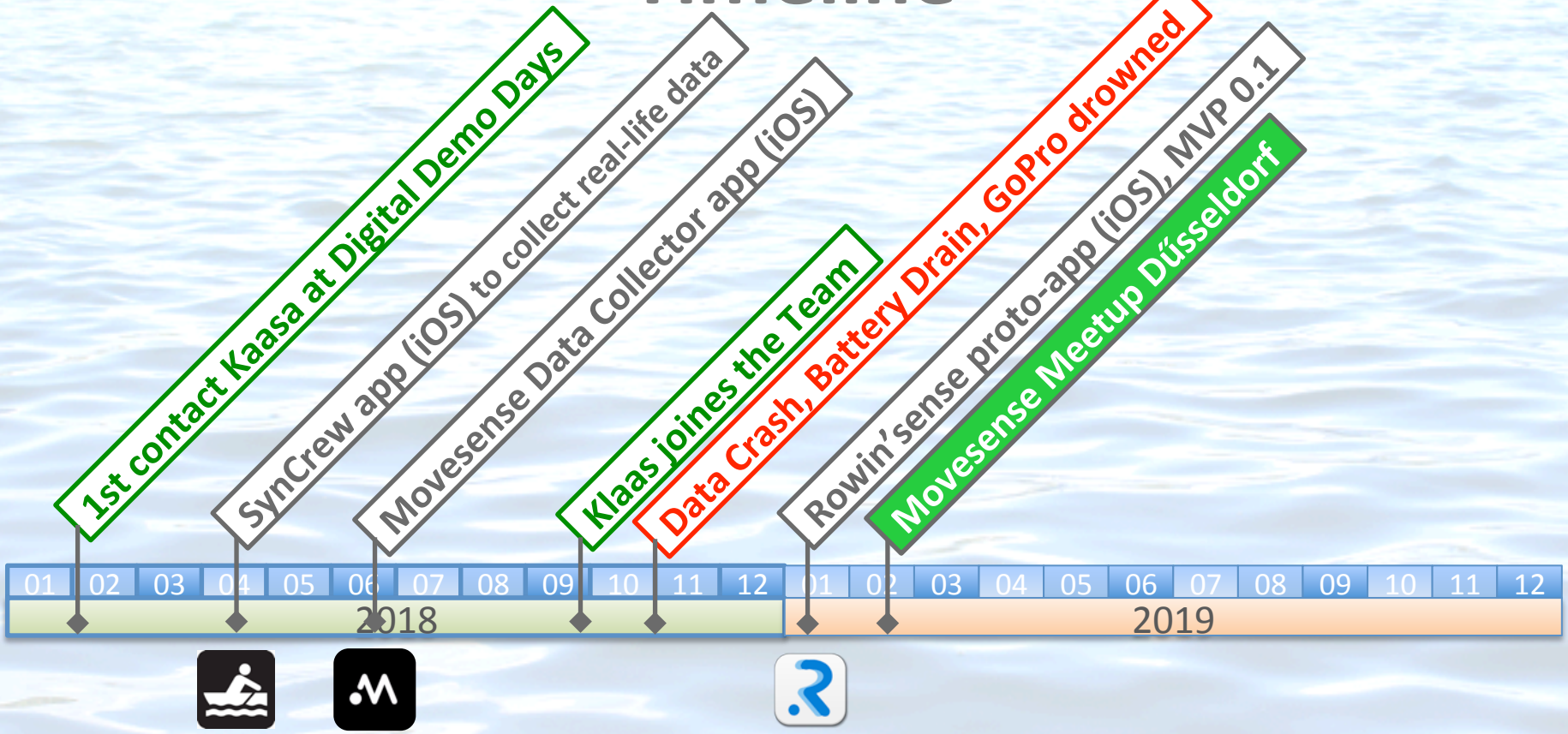
. . . and all connected !



Environment characteristics

- Outdoor / Open Air
- Multi-sensor (3 – 24 devices)
- Multi-smartphone (1 – 10 devices)
- Distance sensor(s) – smartphone(s) < 10 m
- Distance shell – coach > 20 m (upto 100+ m)

Timeline



1st Ideas

Feasibility Testing

1st Spec

Prototyping, MVP 0.1 – 1.0

β-Testing, MVP 2.0

UI / MVP 3.0

Go to Market

Rowing is a “small” sport

Some explanation may be needed

Sport Popularity	Worldwide		Germany		Netherlands	
	GII Score	Rank	Members	Rank	Members	Rank
Football (Soccer)	2423	**1**	7.090.000	1	1.217.540	1
Basketball	1413	**2**	208.000	17	51.000	18
Tennis	1133	**3**	13.840.009	3	570.000	2
Golf	398	**9**	645.000	9	377.000	3
Gymnastics	78	**24**	4.980.000	2	300.000	4
Rowing	14	**49**	**86.000**	**28**	**35.000**	**24**

GER + NED: top rowing countries

Successful Rowing Countries	Inhabit-ants [mio]	Olympic Medals 2000-2016		National Rowing Community	
		Rank	Medals	Clubs	Members
Great Britain (GBR)	65	**1**	**27**	550	33.000
Australia (AUS)	23	**2**	**20**	200	20.000 est'd
Germany (GER)	81	**3**	**18**	480	85.000
New Zealand (NZL)	5	**4**	**13**	70	7.000 est'd
United States (USA)	327	**5**	**13**	1.200	180.000 est'd
Netherlands (NED)	17	**6**	**12**	120	35.000
Italy (ITA)	62	**7**	**11**	225	22.500 est'd
France (FRA)	63	**8**	**10**	420	45.000
Romania (ROU)	22	**9**	**9**	30	4.500 est'd
Denmark (DEN)	6	**10**	**9**	140	16.350

Types of racing shells

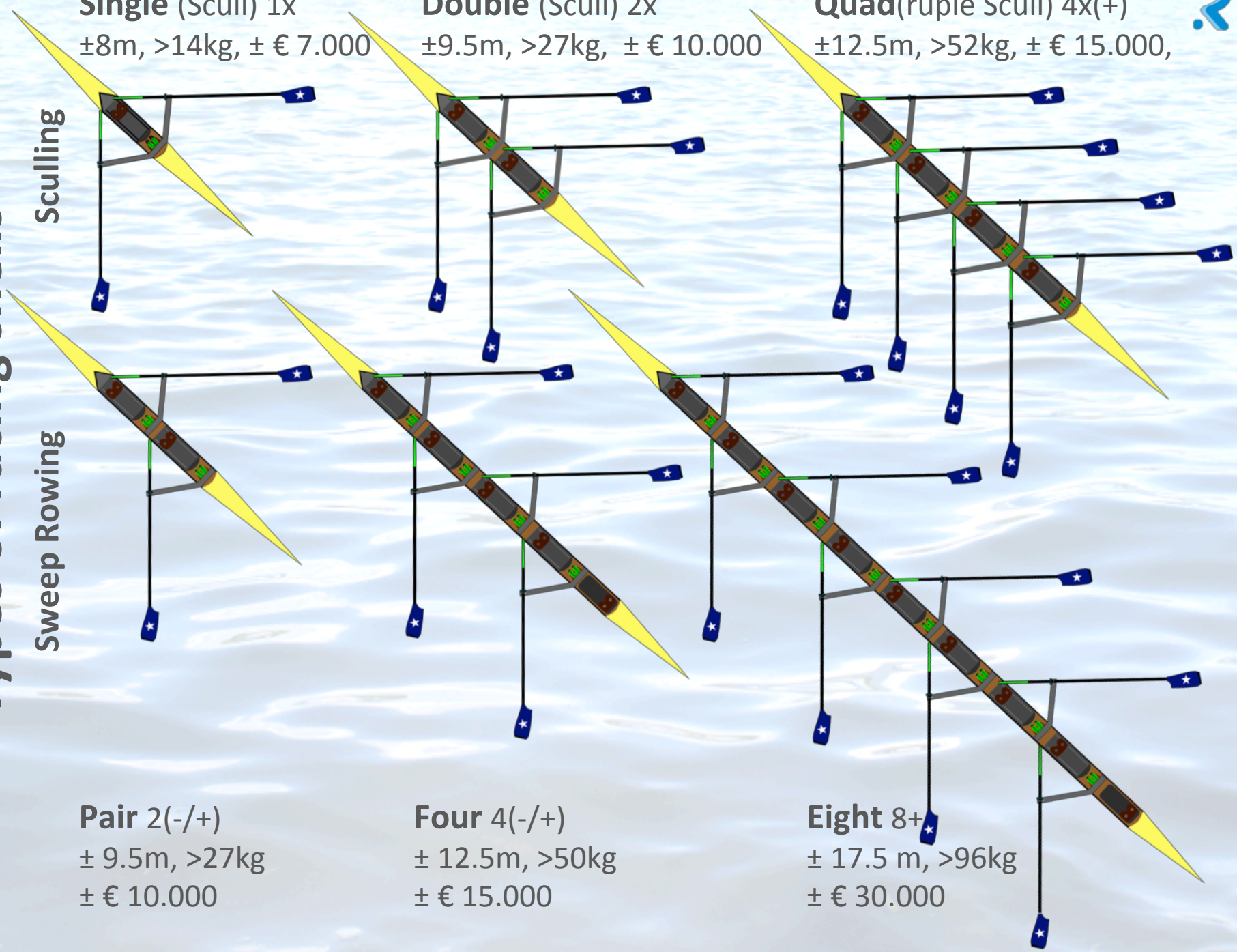
Sculling

Sweep Rowing

Single (Scull) 1x
±8m, >14kg, ± € 7.000

Double (Scull) 2x
±9.5m, >27kg, ± € 10.000

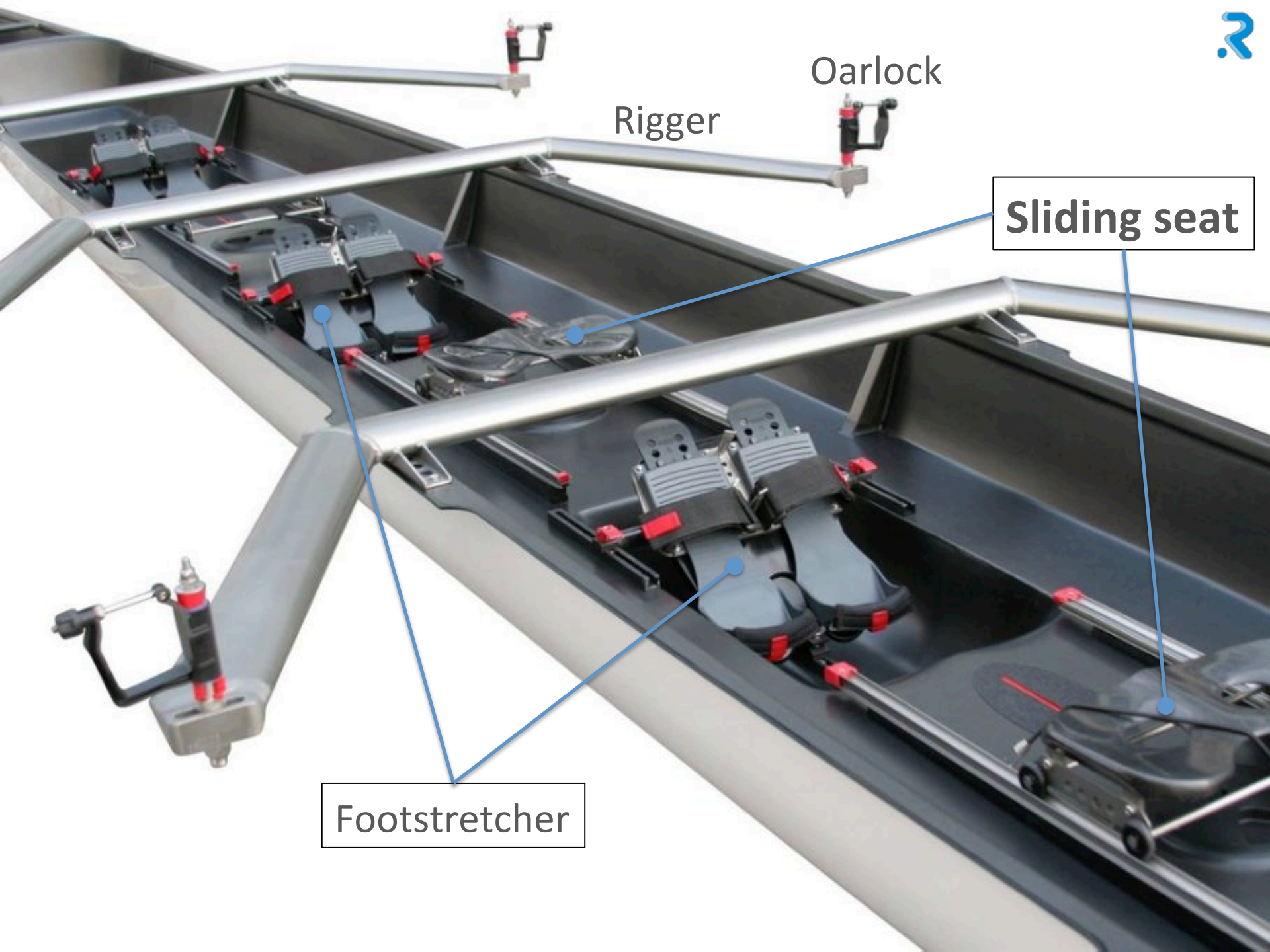
Quad(ruple Scull) 4x(+)
±12.5m, >52kg, ± € 15.000,



Pair 2(-/+)
± 9.5m, >27kg
± € 10.000

Four 4(-/+)
± 12.5m, >50kg
± € 15.000

Eight 8+
± 17.5 m, >96kg
± € 30.000

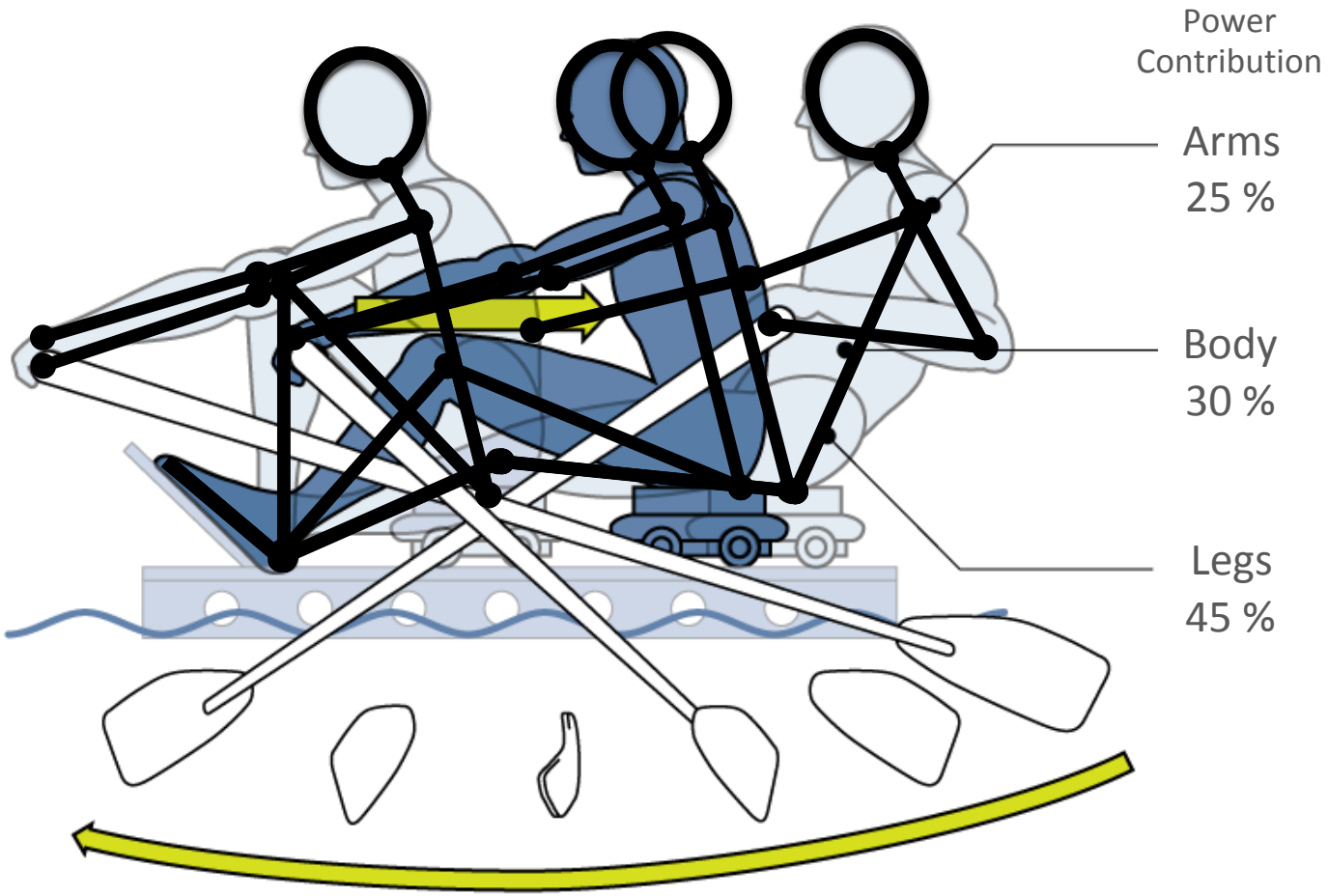

Oarlock
Rigger
Sliding seat
Footstretcher

Indoor rowing machines
Ergometers (Erg's)

Phases of the Rowing Movement

D R I V E

1. Catch 2. Slide (stretch legs) 3. Body backwards 4. Pull arms

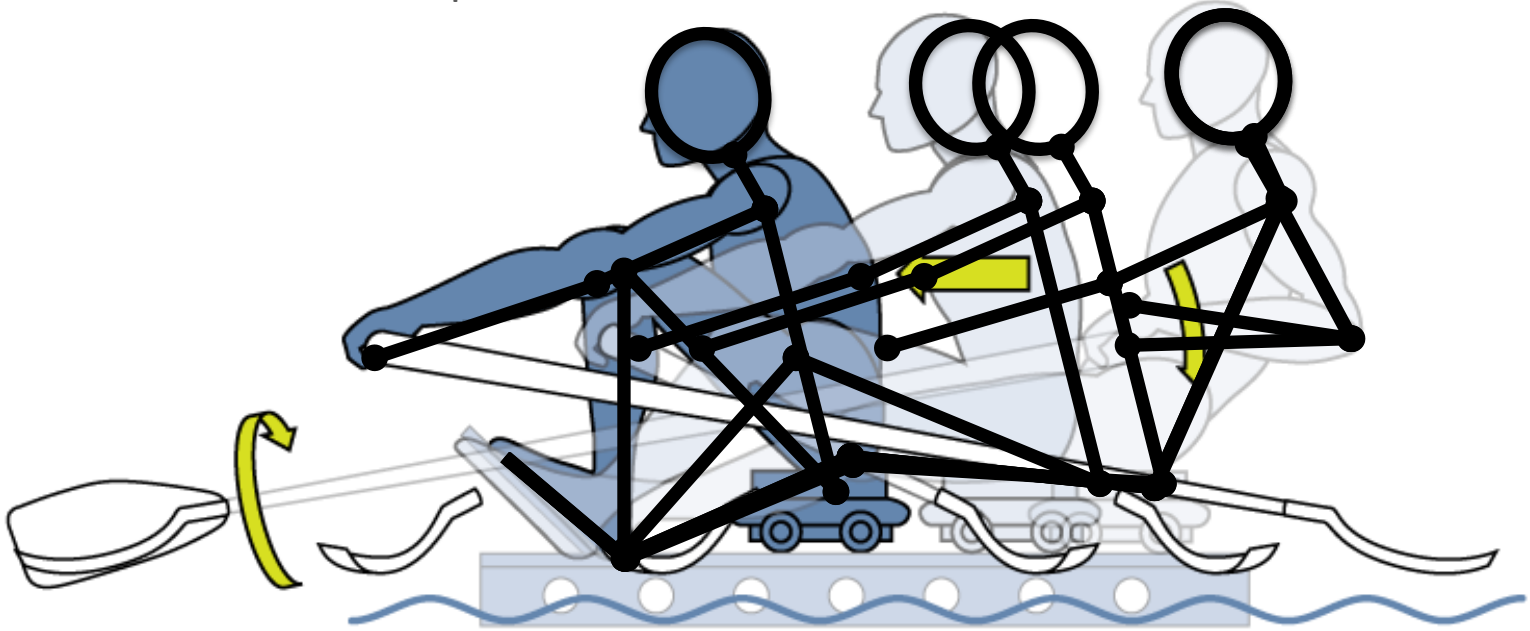


Phases of the Rowing Movement

R E C O V E R

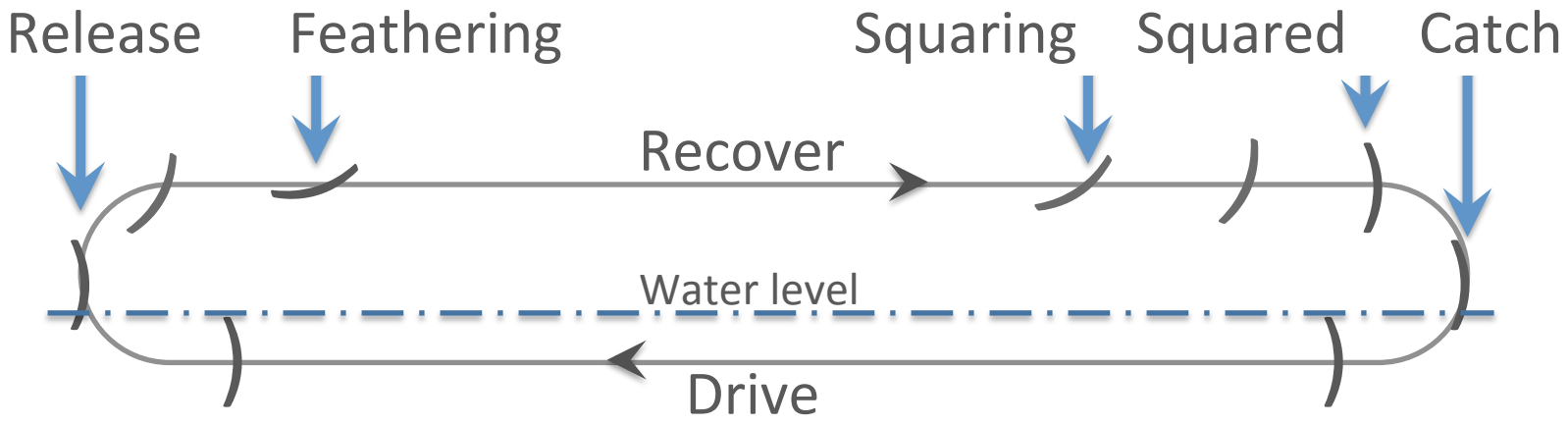
4. Slide (compress legs) 3. Body forward 2. Stretch arms 1. Release blades

Square blades Feather blades

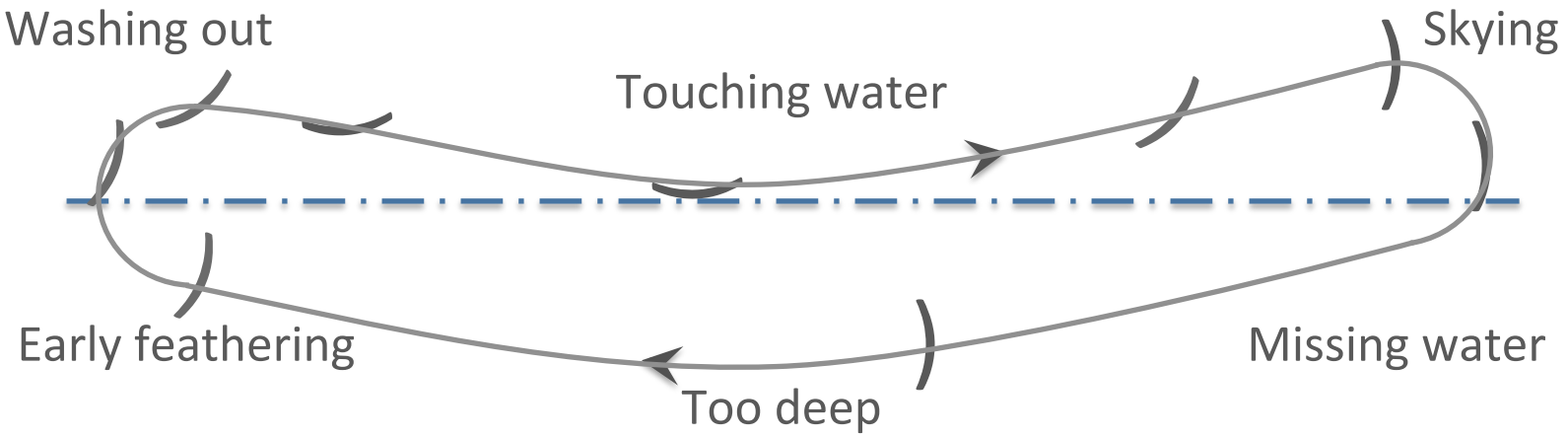


Blade work, ideal

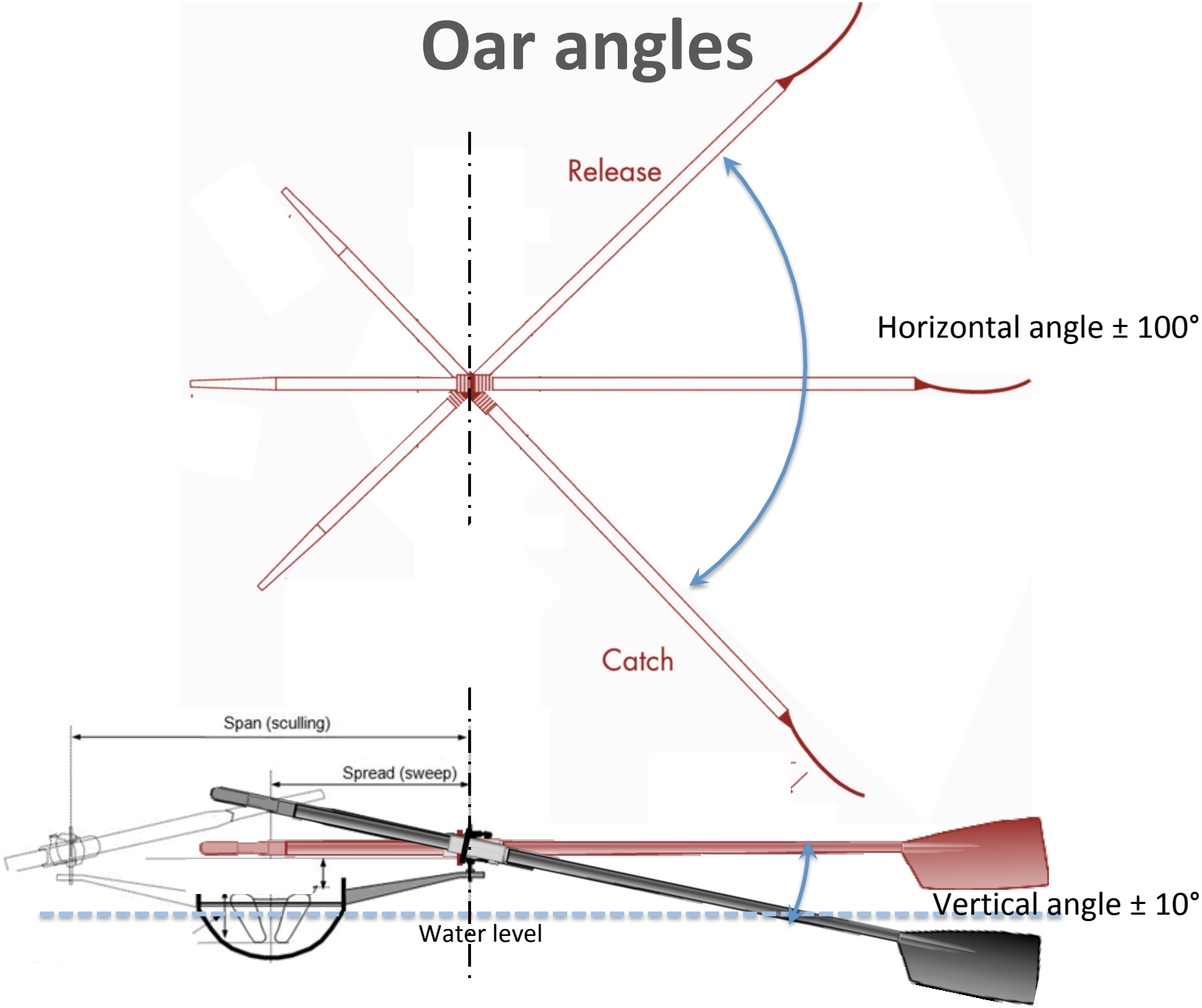
Directly connected to handle work



Blade work, common errors



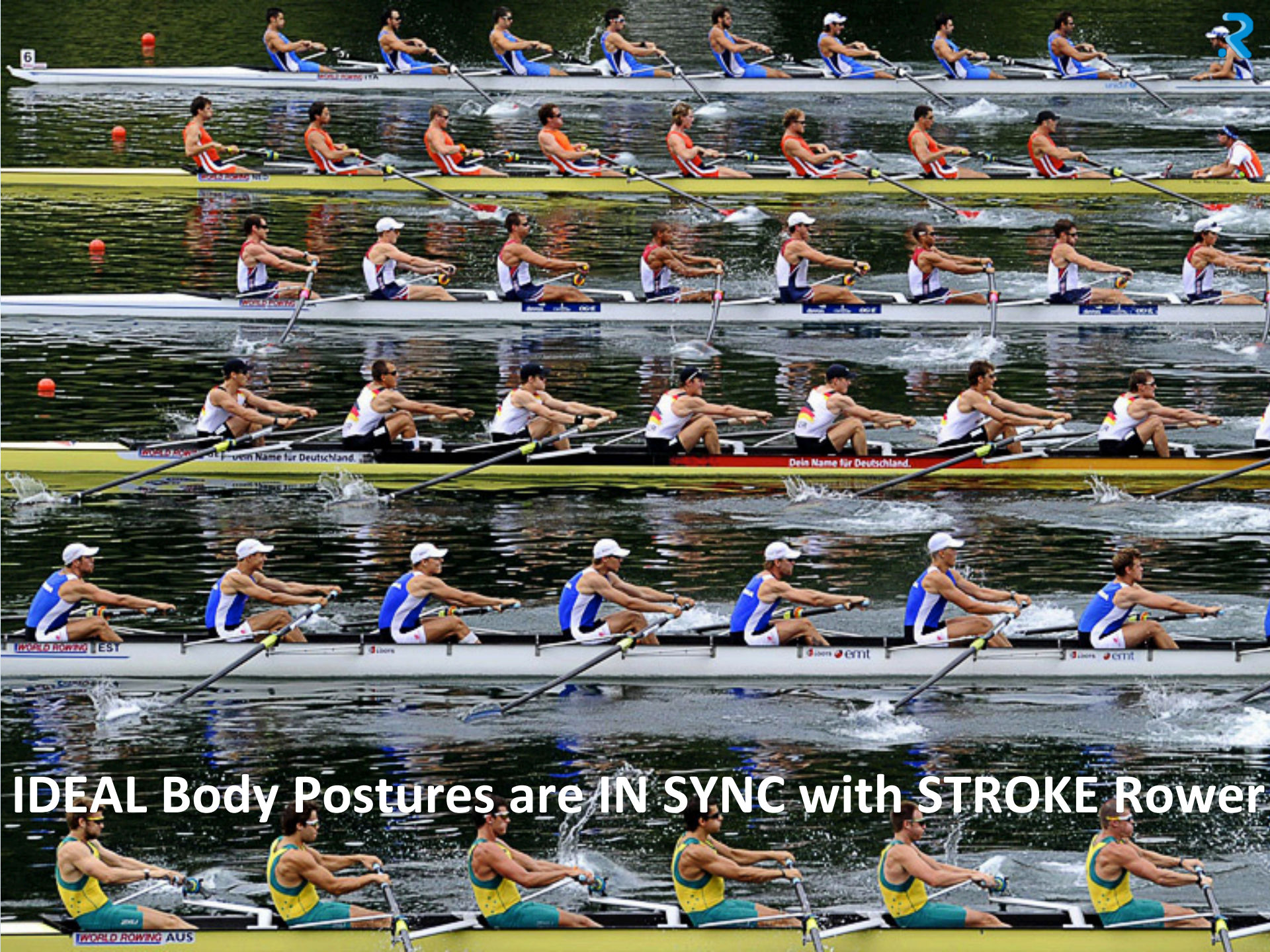
Oar angles



Horizontal angle ± 100°

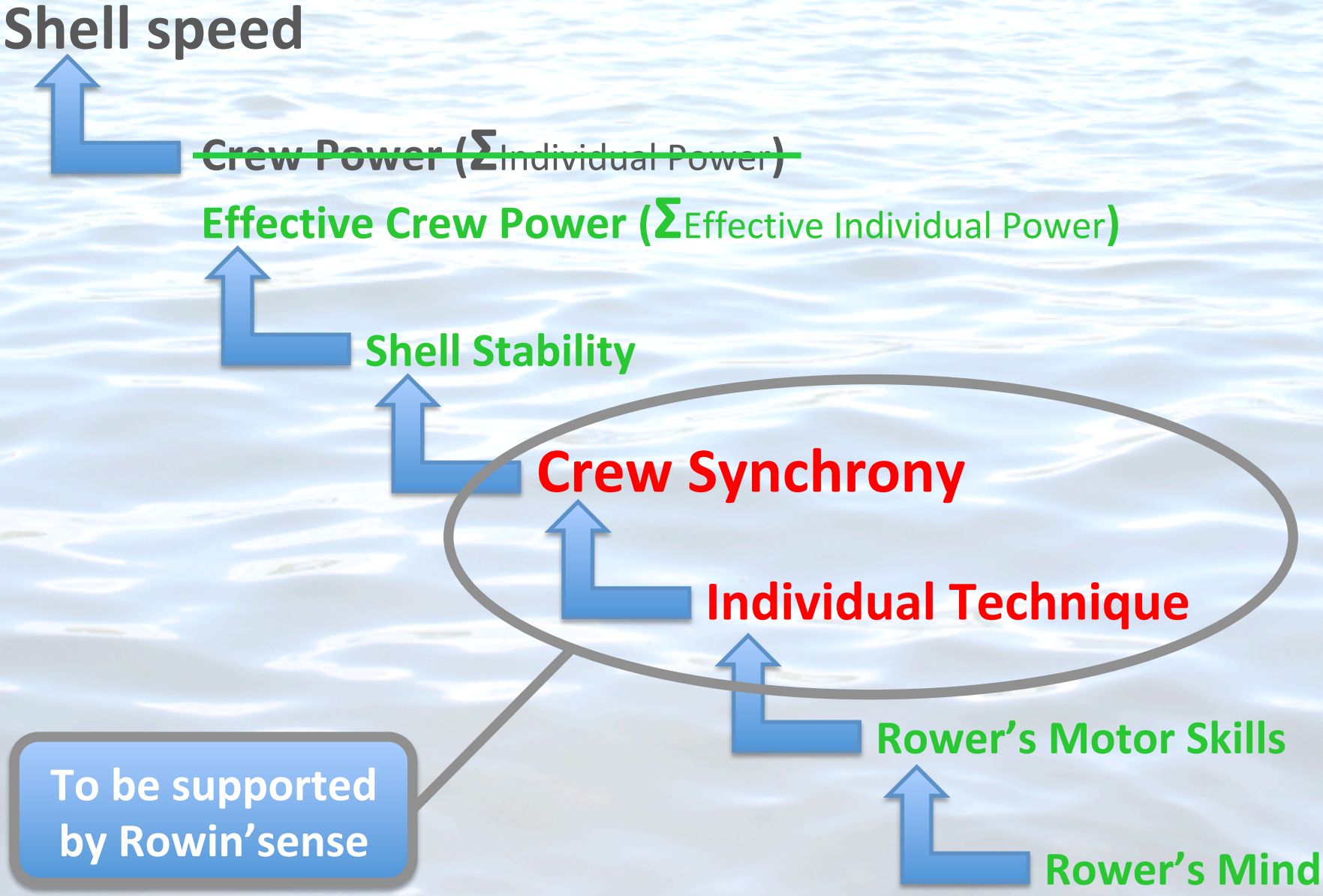
Vertical angle ± 10°


IDEAL Blade Work is IN SYNC with STROKE Rower


IDEAL Body Postures are IN SYNC with STROKE Rower

Rowing Performance: Critical Factors

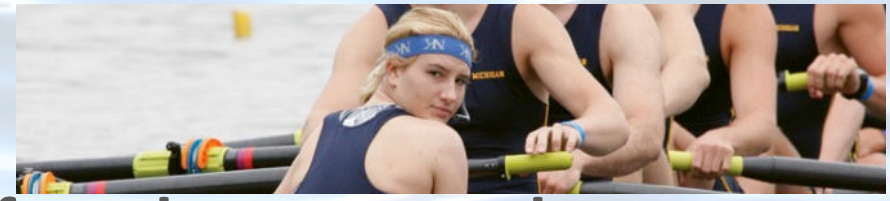
Given specific shell characteristics & rigging



Essence of Rowin'sense

- Visualize what's not seen by "naked eye"

  - Coach
    - Sees (individual) body postures good
      - (but) difficult to focus on total crew
    - Sees some blade work (at his side only)
    - Sees pitch & surge movements of the shell



  - Cox
    - Sees body posture of stroke rower only
    - Sees blade work
      - (but) difficult to focus on total crew
    - Feels shell balance
      - (but) difficult to point out cause(s) for unbalance

Essence of Rowin'sense

✧ When Rower looks at his blade work

- He may improve that blade work then, but
- Misses timing with the stroke rower, and
- After looking forward, blade work gets sloppy again

Therefore:

✓ Real time feed back to rower(s) needed

without loosing focus on stroke rower

Essence of Rowin'sense

- **Real time presentation to the rower(s)**
  - ✓ **Experience flaws when happening**
    - Flaws are hardly recalled at later debriefings
  - ✓ **Real time feedback: Feel improvement**

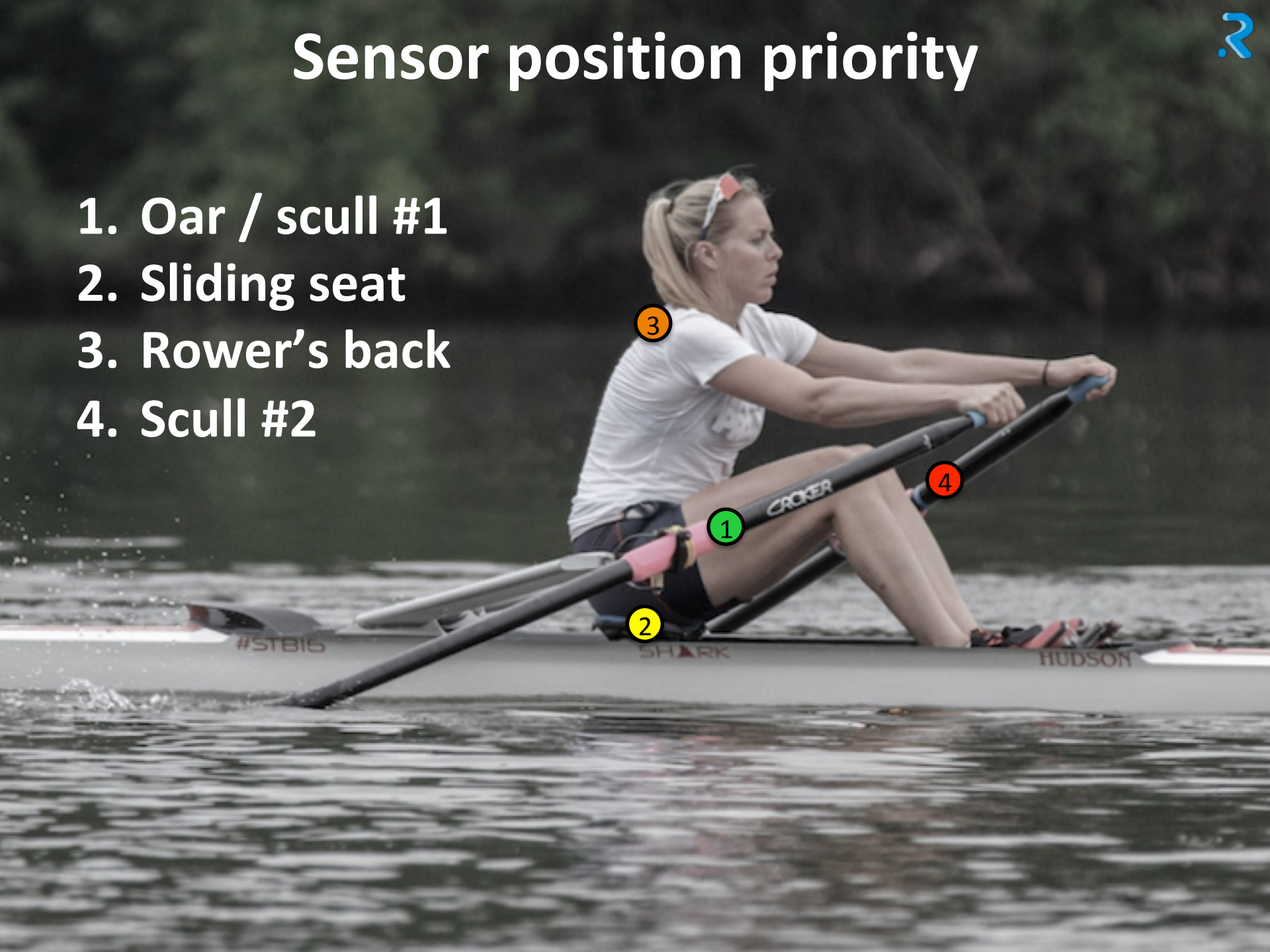
Data presentation to rowers:

- **Not too much !**
- **Focus on "1 aspect"**

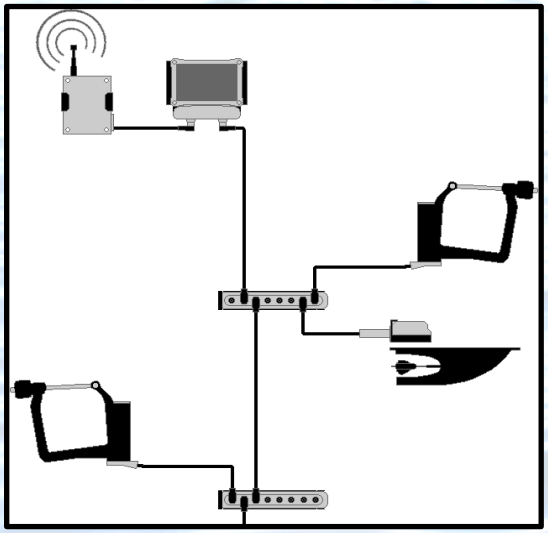
Drawback: display at low position → bad body posture

Sensor position priority

1. Oar / scull #1
2. Sliding seat
3. Rower's back
4. Scull #2

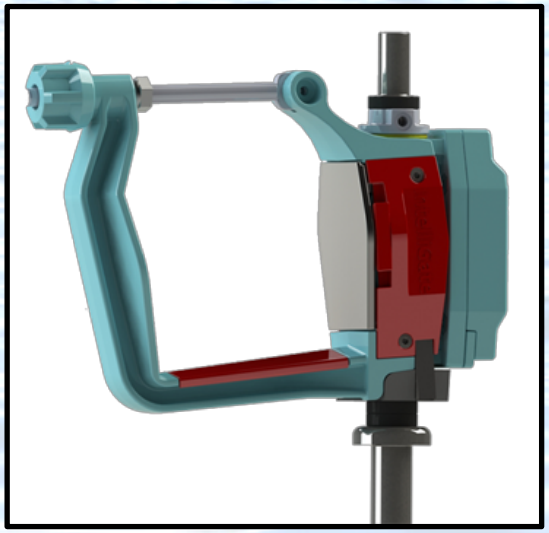


Competition / Existing Systems



Peach PowerLine (GBR)
± € 600/oarlock

NK EmPower Oarlock (USA)
± € 500/ea



Oar Inspired Intelligate (AUS)
± € 200/ea

Quiske RowP pods (FIN)
± € 250/ea

- **Movesense-based system: upto 5 x more cost effective**
- **No "all round" systems** (power + h/v-angles+ position + velocity + timing)
- **Movesense-based system benefits sensor versatility**

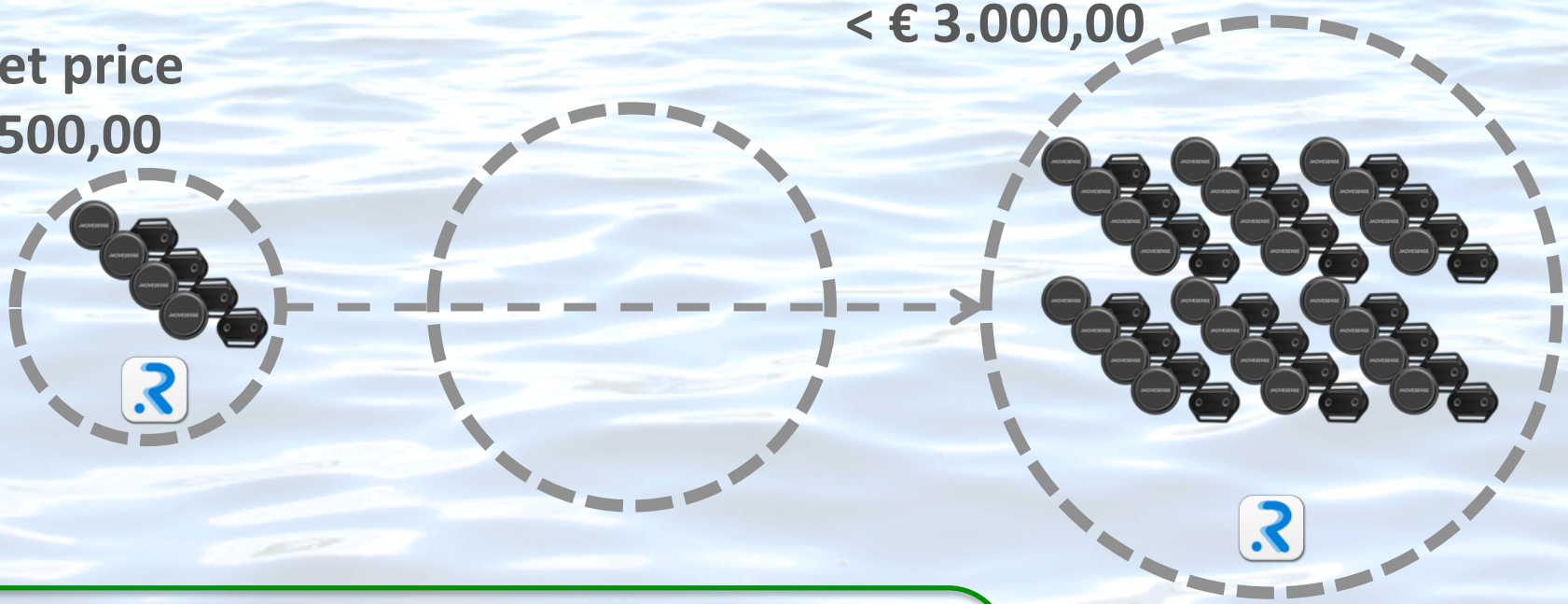
❑ **The Dutch national rowing teams use systems of ± € 30.000**

Intended System/Product Range

Expected Market Size in EU: > 1000 systems

Target price
< € 500,00

Target price
< € 3.000,00



- 4x Movesense
- 4x Smartmount
- Mounting material
- App for 1 smartphone
- Analysis SW

OK for:

- ✓ Erg (3-4 sensors/rower)
- ✓ 1x (4 sensors/rower)
- ✓ 2-/2x (2 sensors/rower)
- ✓ 4-/4x (1 sensor/rower)

- 24x Movesense
- 24x Smartmount
- Mounting material
- App for ∞ smartphones
- Analysis SW
- Network of 10 devices

System Concept

- **Affordable** for (medium size) rowing clubs and individuals
- Based on **Movesense** units + dedicated FW
  - On oars/sculls, seats, rower's back
- **Smartmounts** with straps
- **Smartphones** (iPhone first, Android later)
  - With **App** for
    - Real time data processing
    - Real time data presentation
    - Data transmission
  - Tablet as alternative for Smartphone (for Coach or Cox)
- **Data Analysis SW** (PC or Web-based) for offline use

System Characteristics

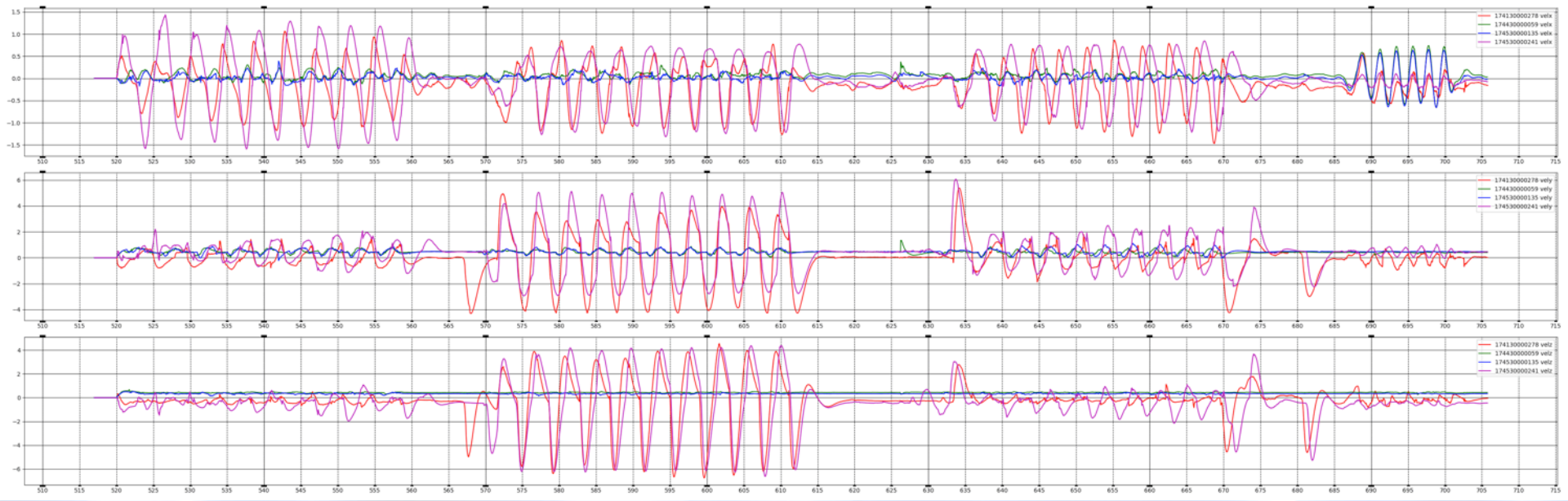
- **WOW-factor**
  - Installation tolerant
  - Minimal calibration
  - Plug & Play

- **User Interface** Attractive and Intuitive
- **Free of Charge** Basic App(s)
  - SW costs covered in HW-price
- **User community** (open API)
  - Target group: drive, expertise
    - On rowing and SW-development
  - Access to external expertise
    - We have no monopoly of wisdom
    - User's own App-development (and "free" distribution)
  - Create great customer loyalty
  - Deliver high added value for the customer

Live testing at the Club

Scull & Seat velocity

2 sensors mounted to SB sculls (purple Stroke, red Bow)
2 sensors mounted to the seats (blue Stroke, green Bow)



Test scenario

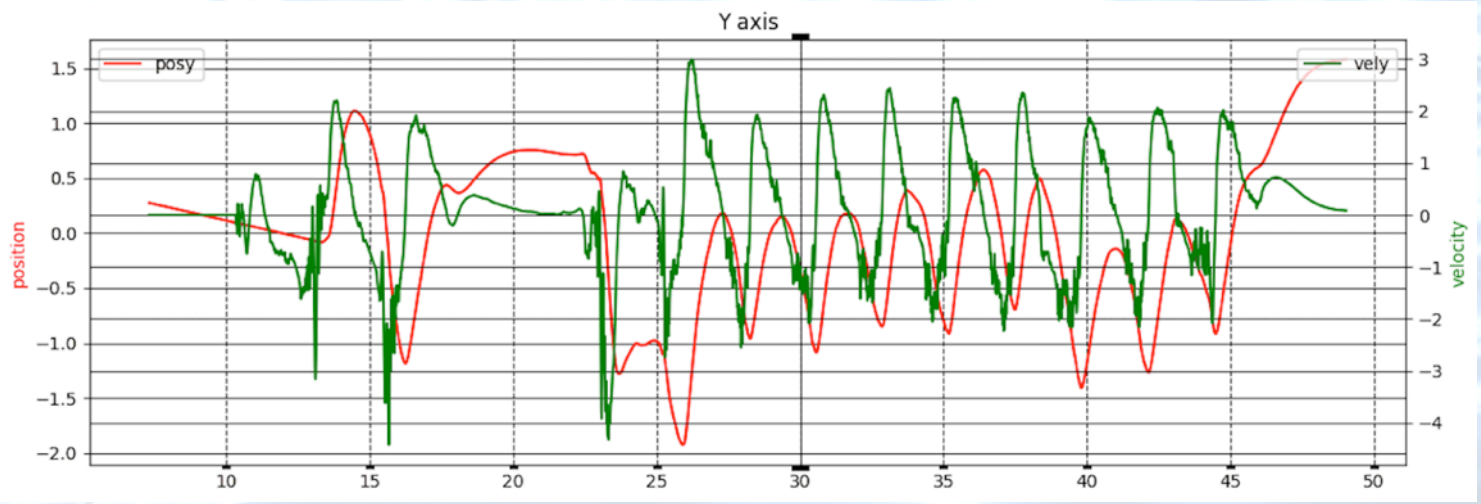
10x strokes in sync, vertical (fixed) blades
10x strokes in sync, feathered (in sync) blades
10x bow rower catches earlier, vertical (fixed) blades
10x rolling the shell +/- 10 degrees (no shell velocity)

Test indoor rowers: sensor @ handle

Difference in “smoothness” between C2 and WR
C2: chain (+ wear); WR: belt

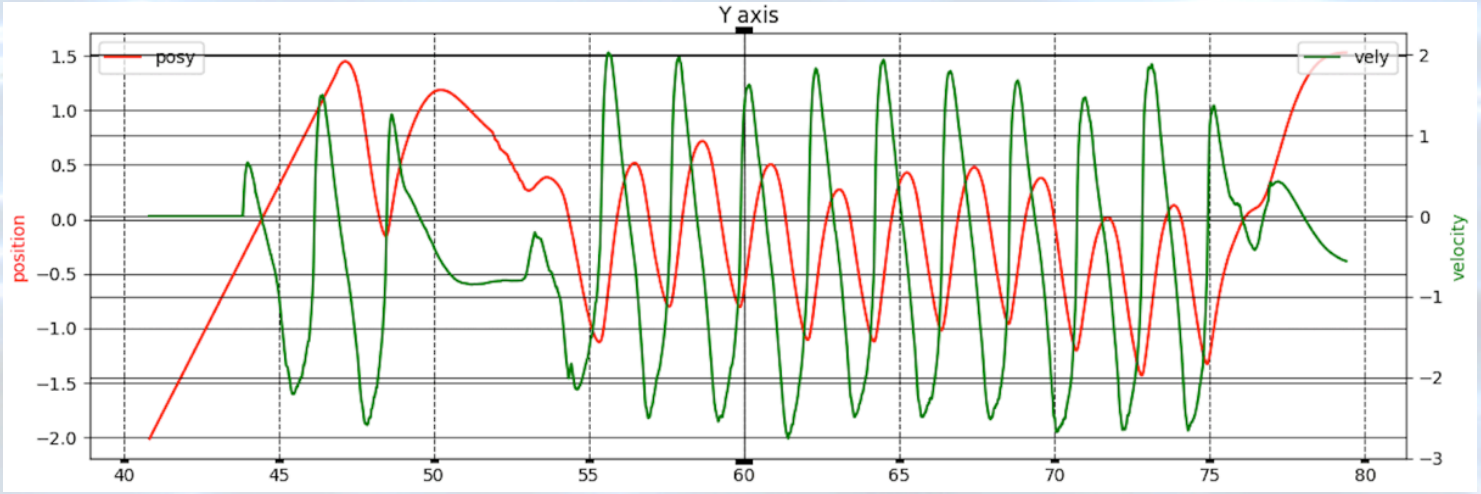
Concept2 Model C

4 different erg’s tested



Waterrower

2 different erg’s tested



Problems encountered

- ★ Connect & Sync
  - ✓ Movesense Data Collector App
- ★ Data collection
- ★ Cache retrieval
  - ✓ Patience
  - ✓ FW update sensors
- ★ Data crash
- ★ Battery drain
- ★ GoPro lost: drowned

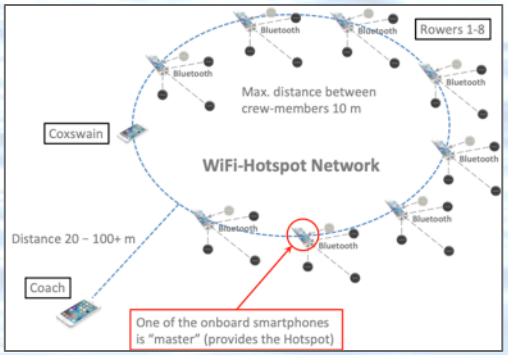
Current status

- **Essence of the feasibility testing**
  - **What do we see?**
    - Good global indications
    - Practical aspects verified
    - Sensor mounting positions
    - Connect & sync experience
  - **Conclusions**
    - **Ideas are feasible**
      - Measurement data seems complete
    - **Transmission ranges look OK / Useful**
    - **Detailed data interpretation by rowing profs**
      - ✓ **Offer a basic “Toolbox” (community idea)**
- **Initial Prototype spec ready**
- **Initial SW Model for simulations**
- **Prototype MVP 0.1 ready**

Challenges
1. Data Transmission

Is pictured Network feasible?

- Max. 4 Bluetooth devices per smartphone?
- 10 devices in Personal Hotspot Network?
- Data rate / Network performance?
- Internal Network interference?



Better solutions available?

- WPAN: Wireless Personal Area Network
- Piconet (Bluetooth): 1 Master device + 7 Slaves
- Scatternet (Bluetooth): existing of 2 or more Piconet's
- Nordic Semiconductor: nRF MESH (app)
- . . . . . .

Experiences?

- Anybody with comparable Network experience?

Challenges

2. **Synchronisation of devices**
3. **Accuracy of vertical oar-angle data**
4. **Android devices**
5. **User Interface:** make it really awesome!
6. **Possible external interference**
7. **Alternatives for “look-down-displays”**
   - HUD, Sonification, AR/VR-glasses
8. **Maximum recording time** (> 10 mins)






Any ideas?

End of presentation

Rowin'sense

powered by

MOVESENSE

Questions?