



HAPTIC SOLUTION PROVIDER

ROADMAP

2007...

FOUNDATION

WE ARE YOUR
COLLEAGUES FROM
THE ACOUSTIC
DEPARTMENT

ACOUSTIC
TECHNOLOGY



STARTED WITH
5 EMPLOYEES
IN HAMBURG



ISO 9001
IATF 16949
ISO 14001



TIER 1



CUSTOMIZED



PARTNER
BESTAR



PART OF THE
BESTAR HOLDING
WITH MORE THAN
1000 EMPLOYEES
AND OVER SIX OWN
PRODUCTIONS



GREWUS GMBH
**GLOBAL COMPETENCE CENTER
FOR ACOUSTICS AND HAPTICS**
Hamburg, Germany

BESTAR TECHNOLOGIES INC.
Chicago, United States

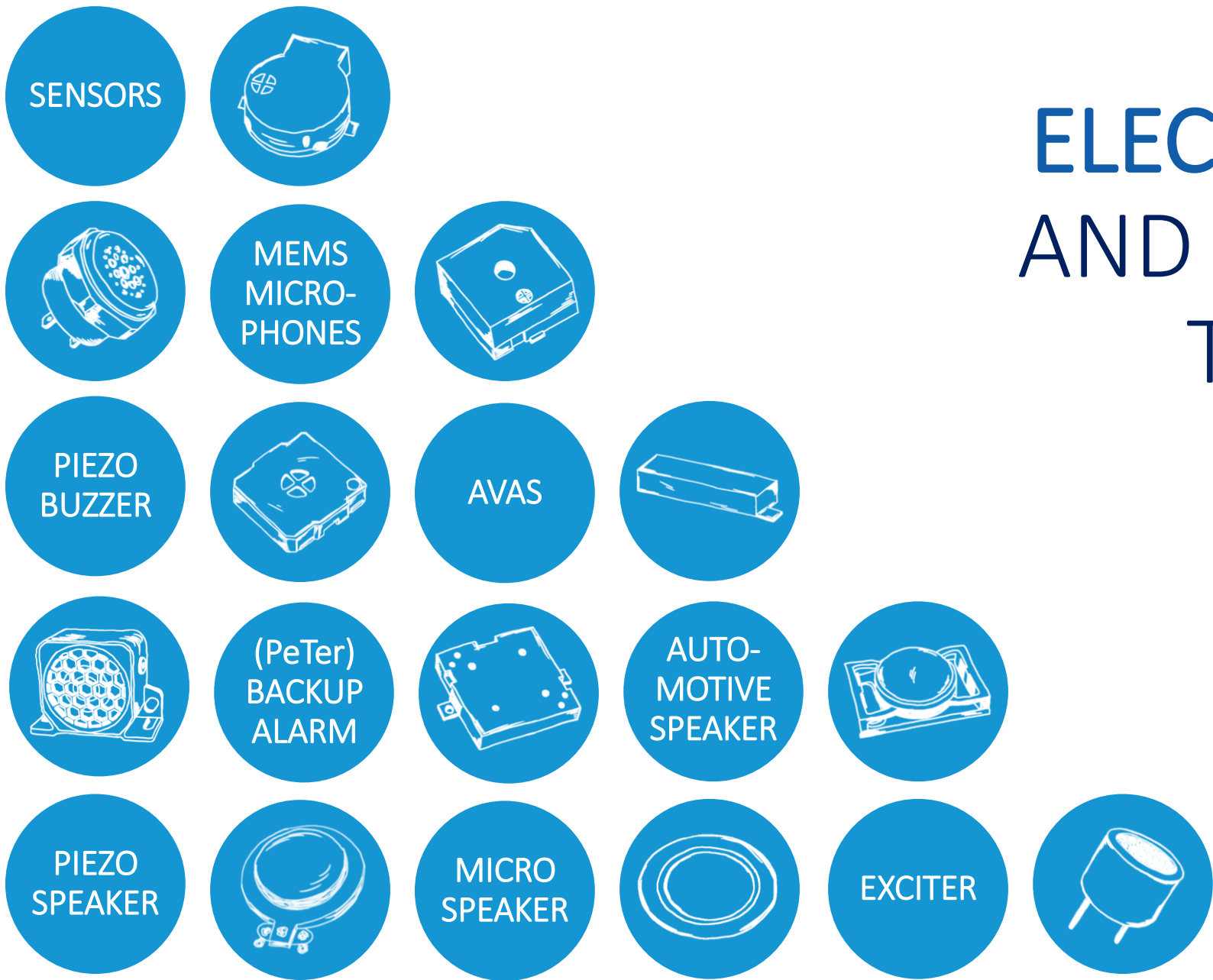
AUDIO UNLIMITED INCORPORATION
SHYCH ADVANCED MATERIAL
Changzhou, P.R. China

BESTAR HOLDING
BESTAR SENSORS
ANYI TECHNOLOGY

BESTAR TECHNOLOGY
Shenzhen, P.R. China

BESTAR TECHNOLOGY
Suwon-Si, South Korea

BESTAR TECHNOLOGY
Osaka, Japan



ELECTROMAGNETIC AND PIEZOELECTRIC TECHNOLOGIES

2015...

START OF THE
FIRST **EXCITER**
ACOUSTIC
PROJECTS

HAPTIC
TECHNOLOGIES

30 MIO.
PIECES A
YEAR

2016...

HAPTIC TECHNOLOGIES

LRA /
ERM

SINGLE AND
MULTILAYER
PIEZO

EXCITER

VOICE COIL

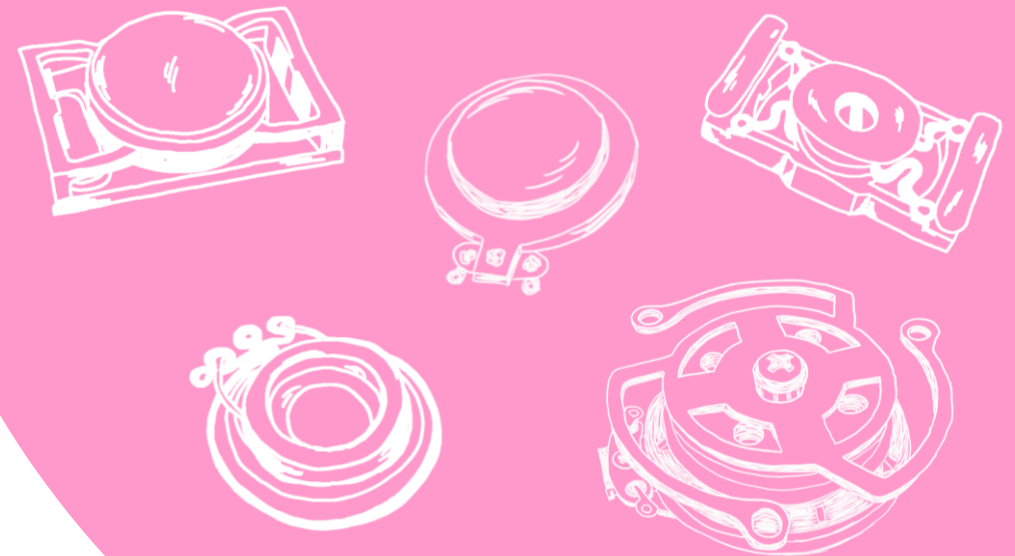
DUAL USE:
HAPTIC AND
ACOUSTIC IN
ONE DEVICE

FREE TO MODULE
THE FREQUENCY AS
WELL AS AMPLITUDE
THROUGHOUT THE
WHOLE FREQUENCY
RANGE

WEATHERPROOF,
AS NO SOUND
OUTLET OPENING
DUE TO THE
CONSTRUCTION
IS REQUIRED

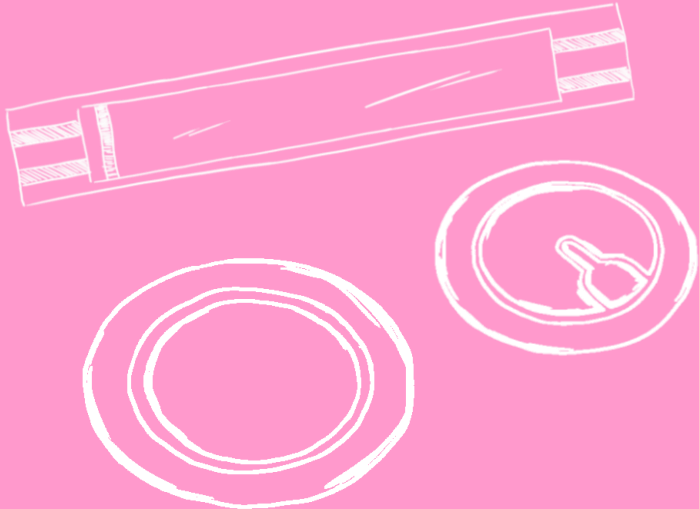
THE EXCITER THE MUSCLEMAN FOR COMPLETE USER INTERFACES

(SUSPENDED SYSTEM)



PIEZOS DUAL USE POSSIBILITIES: SENSORS OR ACTUATORS

(ATTACHED SYSTEM)



GLOBAL OR
LOCAL PRECISE
HAPTIC
FEEDBACK

MECHANICAL
CLICK-FEELING
VIA ELECTRONIC
COMPONENT

WIDE FREQUENCY
RESPONSE, SILENT
OPERATION, AND
ABILITY TO CREATE
HIGH DEFINITION
HAPTICS EFFECTS

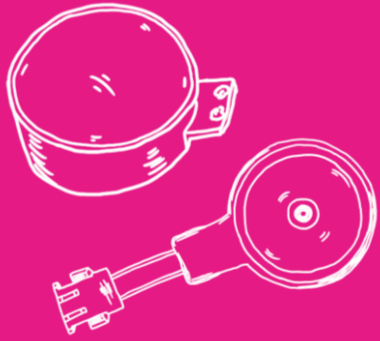
MAXIMUM
POWER WHILE
MAINTAINING
LOWEST WEIGHT

GLOBAL FEEDBACK,
HIGH ACCELERATION,
FAST RESPONSE TIME
AND EASY CONTROL

THE VOICE COIL BROADER FREQUENCY AND HIGHER DEFINITION HAPTIC RESPONSE

(ATTACHED SYSTEM)

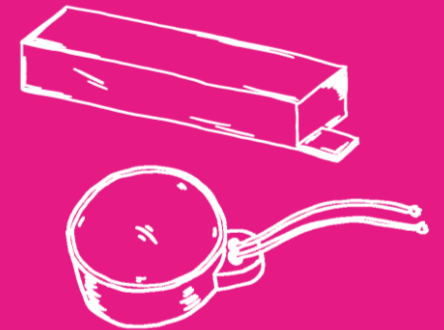




LRA / ERM

HAPTIC FEEDBACK FOR HANDHELD DEVICES AND SMALLER APPLICATIONS PROVIDED BY MOVING MOTORES

(SUSPENDED SYSTEM)



2018...

COOPERATIONS

GLOBAL HAPTIC
COMPETENCE
CENTER AND
HAPTIC SOLUTION
PROVIDER

WE MAKE
YOUR IDEAS
TACTILE

HAPTIC COOPERATIONS AND MEMBERSHIPS

LEONHARD
KURZ /
POLY IC
DECOR & SENSOR

HAPTIC
INDUSTRY
FORUM
HAPTICS
STANDARDS

UNIVERSITIES
UNIVERSITY OF NANJING
SDU DENMARK
TUHH HAMBURG
TU DRESDEN
HTW DRESDEN

CIRRUS
LOGIC
DRIVER CHIPS

CYPRESS /
INFINEON
TOUCHSENSING

KUNSTSTOFF-
INSTITUT
LÜDENSCHIED
WORKSHOPS

TACTOTEK
SMART
SURFACES

DEUTSCHES
FLACHDISPLAY-
FORUM
DISPLAYS & HMI's

2021...

HAPTIC GOALS

GREWUS
HAPTIC
INTENSITY
VALUE
(GHIV)

START MASS
PRODUCTION
E-CHARGE
STATION DISPLAY
WITH EXCITER

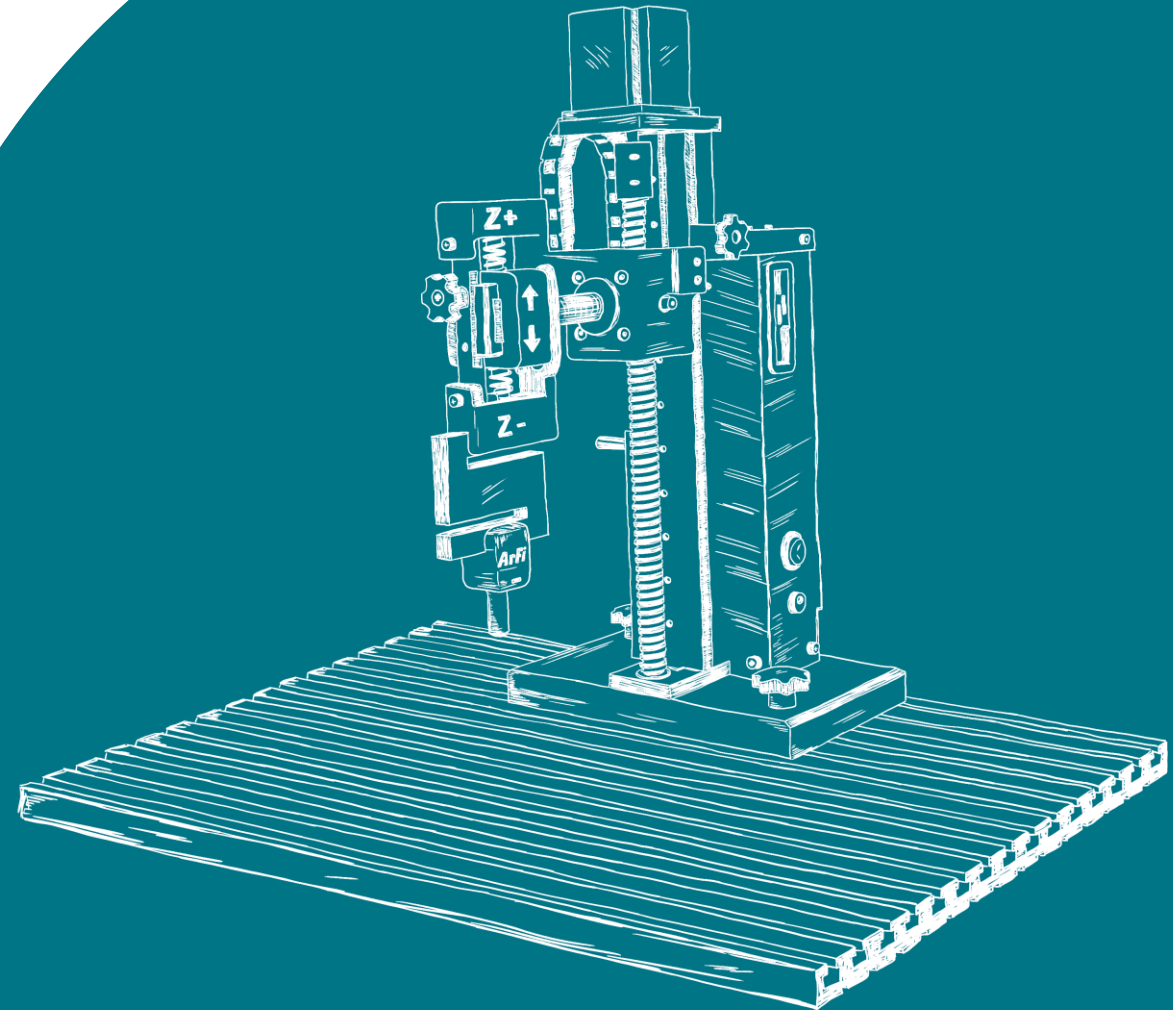
ARTIFICIAL
FINGER
(ArFi)

HAPTIC
EVALUATION
BOARD
(HEBO)

ARTIFICIAL FINGER EVALUATION, SPECIFICATION AND QUANTIFICATION OF HAPTICS

NOT ONLY ACTUATORS SPECS, BUT THE COMPLETE
APPLICATION / SURFACE IS CONSIDERED

STAND-ALONE
DEVICE WITH
ITS OWN
DISPLAY

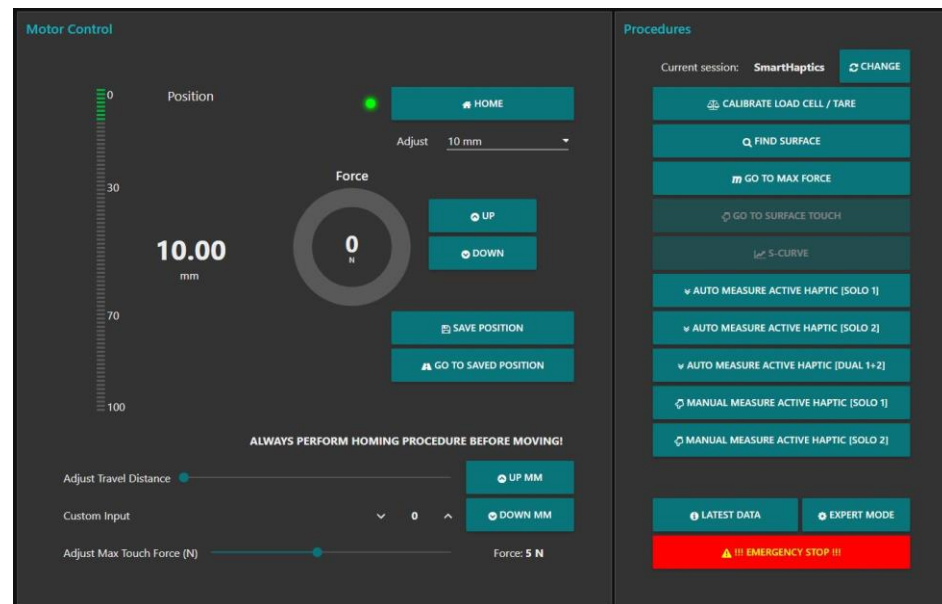


SENSOR 1
UNDER THE
FINGER, WITH
DIFFERENT
SHORE-
HARDNESS

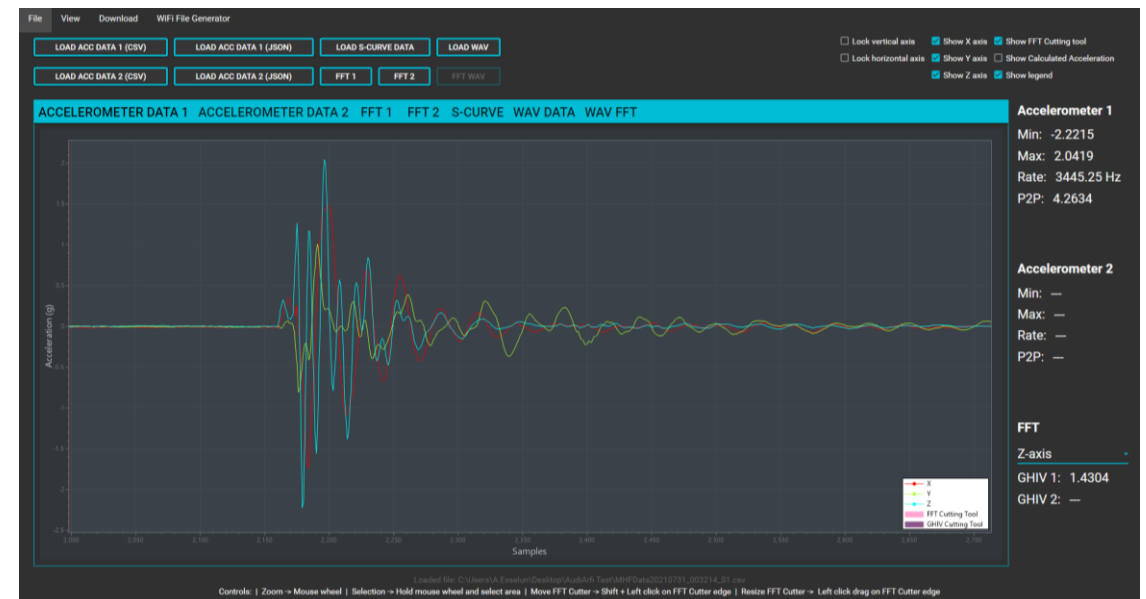
SENSOR 2
ON THE
SURFACE

MICROPHONE
ACOUSTIC
MEASUREMENT

USER INTERFACE



EXAMPLE MEASUREMENT



SWITCHING POINT
MEASUREMENT OF
ACTIVE HAPTICS, WHEN
DOES THE HAPTIC TRIGGER
-> STATIC & DYNAMIC
FORCE TRIGGERING

VERTICAL AND
HORIZONTAL
MEASUREMENTS
POSSIBLE

ArFi
ARTIFICIAL FINGER

Powered by **GREWUS**

ACCELERATION
MEASUREMENT
WITHOUT AND WITH
FORCE (UP TO 10N)
IN X-Y-Z-AXIS

CONSIDERING THE GHIV
GREWUS HAPTIC
INTENSITY VALUE /
HUMAN PERCEPTION

S-CURVE
PASSIVE HAPTICS /
MECHANICAL SWITCHES
CAN BE MEASURED

HAPTIC EVALUATION BOARD FOR ELECTROMAGNETIC ACTUATORS

CONTROL
OF ELECTRO-
MAGNETIC
ACTUATORS
MADE EASY



**PLUG AND
PLAY SOLUTION**
TOUCHDISPLAY, FOUR
READY ACTUATORS,
CHANGEABLE HAPTIC
PARAMETERS

**DRIVING
COMPATIBLE
ACTUATORS:**
EXCITER,
LRA's, ERM's,
SOLENOIDS,
VOICE COILS

HEZO

HAPTIC EVALUATION BOARD

Powered by **GREWUS**

HAPTIC PATTERN
LOAD, EDIT AND
SAVE WAVEFORMS,
TUNE PATTERNS

SENSING
DIGITAL TRIGGER
INPUTS / GPIO's, ADJUST
TOUCH AND / OR RELEASE,
SLIDER FUNCTION

RAPID PROTOTYPING
QUICK CONNECTIVITY
AND A NICE USER
INTERFACE PUTS THE
FOCUS ON THE HAPTIC
AND NOT THE SETUP

2023...

TIER 1
HAPTICS IN
TOUCHSCREENS,
TOUCHPADS,
STEERING
WHEELS AND ON
CURVED SURFACES
OR LARGER CENTER
CONSOLES

TIER 2
LOCALIZED
HAPTICS ON
EXTRAORDINARY
SURFACES (LEATHER,
FABRIC, WOOD)

REQUIREMENTS

**NEXT
GENERATION
EXCITER &
VOICE COIL
INCL. FORCE
SENSING**

**MULTILAYER
PIEZO
LEAD FREE**

**COCKPIT OF
THE FUTURE**

THANK YOU!



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