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Course Information

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- It is the responsibility of course participants to critically evaluate the evidence from multiple sources to guide professional practice.

Introduction to the Nucleus Nexa Cochlear Implant System

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AudiologyOnline | Course #41773 | 1 Hour | Introductory Level

Learning Objectives

After this course, participants will be able to:

- Explain the potential of a smart implant with upgradeable firmware.
- Counsel patients on the benefits of MAPs on the implant with Smart Sync.
- Describe how to program a Nucleus Nexa device in the latest version of Custom Sound Pro fitting software.

Speaker Disclosures

Ginger Grant, AuD, CCC-A, FAAA
Financial: Ginger Grant is employed by Cochlear Americas.
Non-financial: Ginger Grant has no relevant non-financial relationships to disclose.
Jay Patterson
Financial: Jay Patterson is employed by Cochlear North America.
Non-financial: Jay Patterson has no relevant non-financial relationships to disclose.
Sponsor Disclosure
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Section 1: Introduction — What Is a Smart Cochlear Implant?

The Cochlear Nucleus Nexa System is the world's first and only smart cochlear implant system. It comprises the Nucleus Nexa Implant (CI1000), the Kanso 3 Nexa Sound Processor (off-the-ear), and the Nucleus 8 Nexa Sound Processor (behind-the-ear). The defining characteristic of this system is that intelligence — in the form of a processing core, upgradeable firmware, and internal memory — now resides inside the implant itself, not only in the external sound processor.

Cochlear's Mission

Cochlear aims to help people hear and be heard, empowering patients to connect with others and live a full life. The organization transforms the way people understand and treat hearing loss and innovates implantable hearing solutions that deliver a lifetime of hearing outcomes.

From Conventional to Smart Implants

Historically, cochlear implant innovation occurred exclusively through sound processor upgrades — the implant itself was a passive receiver/stimulator. Since the last implant chipset update (the CIC4 in 2005), the field has benefited enormously from sound processor advances: Smart Sound, SCAN, wireless streaming, processor miniaturization, Remote Care, MRI compatibility, and the Slim Modiolar electrode. The new Cochlear NEXOS chipset — introduced in 2025 with the CI1000 — marks the first implant chipset update in nearly 20 years and creates a new category: the smart cochlear implant.

The Research Foundation: Percutaneous Contour Implant Study

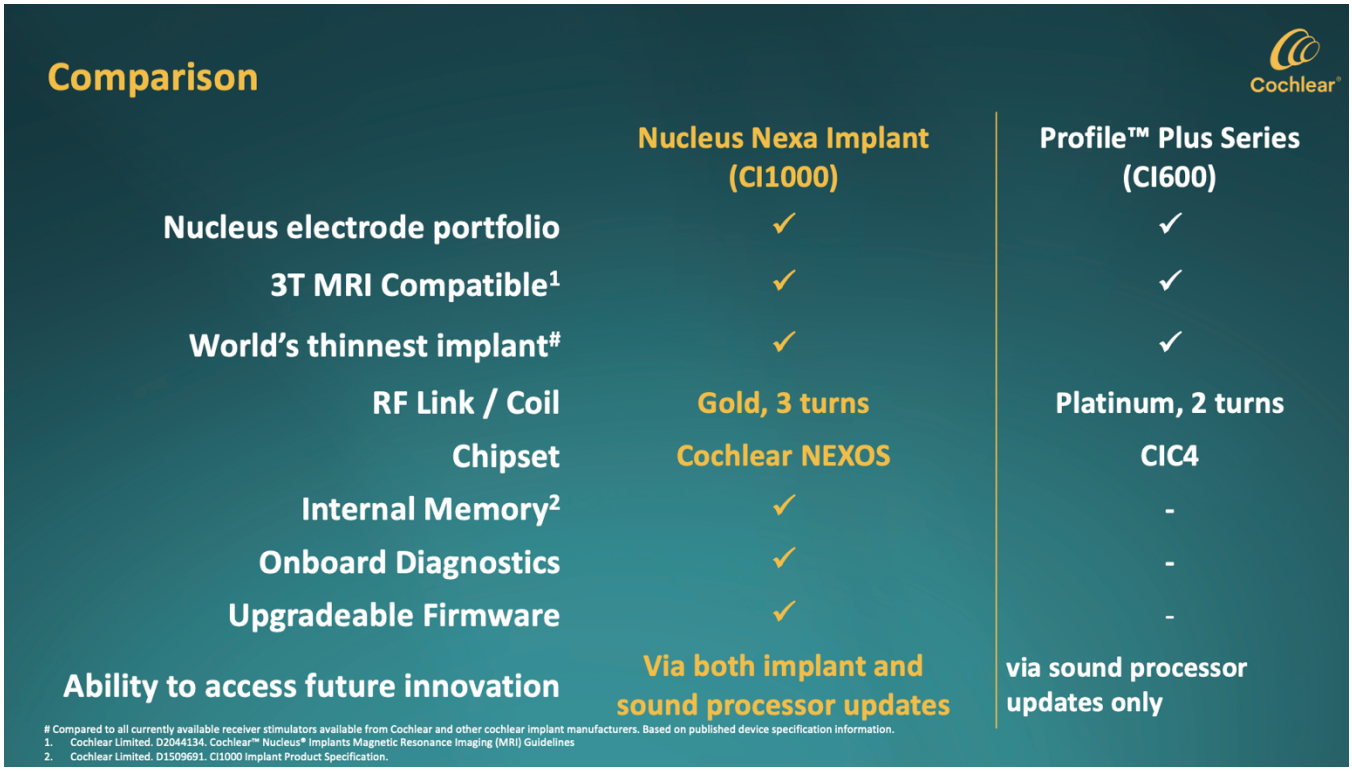
The NEXOS chipset emerged from over 20 years of clinical research using the Percutaneous Contour Implant in Denver. Fifty patients were implanted with a device comprising only an electrode array and connector — no implanted stimulation electronics. Electronics were housed externally, and patients were 'plugged in' to bench-top testing systems, allowing researchers to study novel stimulation strategies without being constrained by internal chip architecture. This foundational research enabled Cochlear to deeply understand the electro-neural interface and optimize stimulation strategies for the CI1000.

Section 2: The Nucleus Nexa Implant (CI1000)

Powered by the Cochlear NEXOS Chipset

The CI1000 implant is powered by the Cochlear NEXOS chipset, which enables three capabilities entirely new to cochlear implants: (1) upgradeable firmware, (2) internal memory, and (3) onboard diagnostics. The implant is also secured by an enhanced RF link. Importantly, it retains the same proven mechanical architecture as the Profile Plus Series (CI600), including the same body and electrical feedthrough, same magnet, same electrodes, and the same manufacturing equipment and processes.

Nexa vs. Profile Plus — Feature Comparison



Comparison table contrasting the Nucleus Nexa Implant (CI1000) with the Profile Plus Series (CI600)....

Reliability

Reliability is paramount for any implanted device. The CI1000 is built on the same proven mechanical platform as the CI600, with an impact resistance of 2.5J. Like all Cochlear implants, it underwent extensive testing including impact resistance, vibrational resistance, hermiticity (fluid/moisture ingress), coil fatigue, electrical functionality under adverse temperature and humidity, and endurance testing of internal memory.

Electrode Portfolio

The Nucleus Nexa System retains Cochlear's full trusted electrode portfolio to accommodate a wide range of patient anatomy and surgical preferences: the CI1012 Contour Advance, the CI1032 Slim Modiolar, and the CI1022 Slim Straight. No changes to surgical technique or instruments are required, as the CI1000 implant body is identical to the Profile Plus Series.

Onboard Diagnostics

The Nucleus Nexa Implant continuously monitors its own functionality — a feature called Onboard Diagnostics. This context awareness means the implant can detect if any operational component moves outside defined specifications and respond automatically. Responses range from a notification push, to an implant reset, to an implant lock in extreme circumstances. This capability may reduce reliance on patients and caregivers to self-report device issues and enables earlier identification and management of performance changes. No other cochlear implant has this capability.

Section 3: Nexa Intelligence — Firmware, RF Link, and Power Management

What Makes Nexa Smart?

For a cochlear implant system to be truly 'smart,' intelligence must exist in both components — the sound processor and the implant. Conventional systems placed all intelligence in the sound processor. The Nucleus Nexa System is the first to embed a processing core, upgradeable firmware, and internal memory inside the implant itself. The critical question is: where does the intelligence live?

Component	What It Enables
Processing Core	Real-time control and coordination of stimulation within the implant
Upgradeable Firmware	Ability to rewrite the firmware on the chip — updating or reconfiguring implant behavior without surgery
Internal Memory	Stores MAPs, clinical data logs, device/program settings, bimodal/bilateral linking data

Upgradeable Firmware

The Nexa implant's firmware is rewritable — meaning the chip can be reconfigured to enhance features and improve performance after implantation, without replacing the device. This is fundamentally different from conventional implants that could only add features via sound processor updates. With Nexa, both implant and sound processor can receive updates, providing access to significantly more innovation over a patient's lifetime.

The Enhanced RF Link

The 5MHz radio frequency (RF) link facilitates bidirectional communication between the sound processor and implant, transmitting both data and power. In previous-generation implants, power and data were sent simultaneously, requiring a careful balance between power transfer efficiency and data integrity. The CI1000 features an enhanced RF link with a gold 3-turn coil (versus the CI600's platinum 2-turn coil) that separates power and data transmission. This optimization directly enables Dynamic Power Management.

Dynamic Power Management

With the CI1000's enhanced RF link, the NEXOS chipset can assess each patient's specific MAP and stimulation requirements, calculate the exact power needed, and instruct the sound processor to deliver precisely that level. This real-time efficiency means wider pulse widths are achievable without a power penalty — and more patients can achieve all-day battery life with a smaller battery module. This is the clinical and technological foundation for the updated programming defaults in Custom Sound Pro 7.1.

Battery Options — Nucleus 8 Nexa and Kanso 3 Nexa

Battery options for the Nucleus 8 Nexa sound processor showing four modules.

The Nucleus 8 Nexa offers four battery options, with the new Power Compact Battery Module as the recommended default. Compared to the Power Extend battery, the Power Compact is 9% smaller and 12% lighter while still providing all-day battery life (defined as 16+ hours). The Kanso 3 Nexa features an integrated rechargeable all-in-one battery providing approximately 21 hours of battery life — approximately 3 hours more than the previous Kanso 2.

Section 4: Nexa Sound Processors and Smart Sync

Kanso 3 Nexa Sound Processor

The Kanso 3 Nexa is the world's smallest and lightest off-the-ear (OTE) cochlear implant sound processor. It features SmartSound iQ 2 with SCAN 2 and automated ForwardFocus, Dynamic Power Management, an integrated rechargeable battery providing all-day battery life, and buttonless tap control. It is the world's first OTE cochlear implant sound processor designed for next-generation Bluetooth LE Audio and Auracast broadcast audio.

Nucleus 8 Nexa Sound Processor

The Nucleus 8 Nexa is the world's smallest and lightest behind-the-ear (BTE) cochlear implant sound processor. It includes SmartSound iQ 2 with SCAN 2 and automated ForwardFocus, Dynamic Power

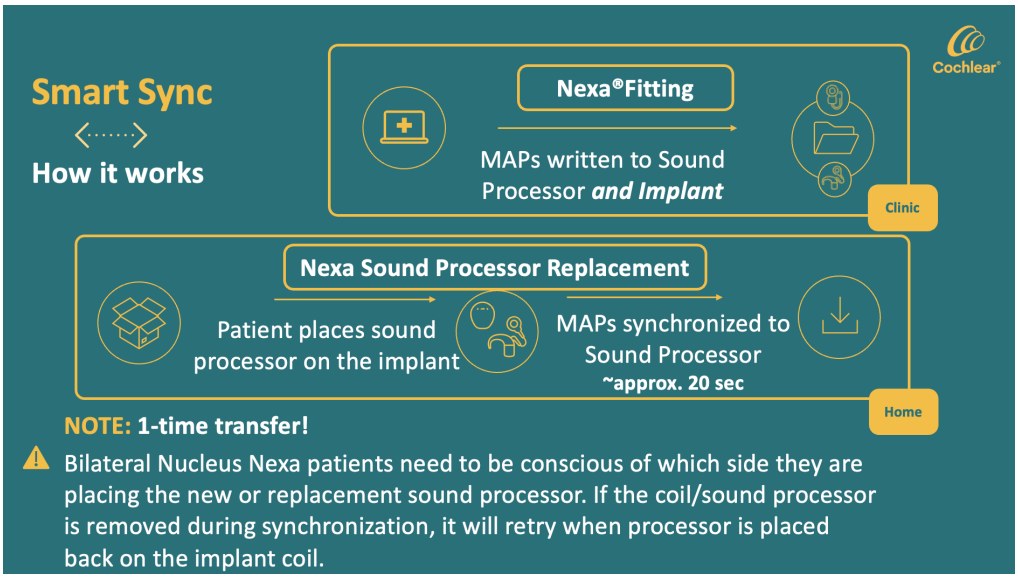
Management with the new Power Compact Battery Module for all-day battery life in a smaller configuration, and readiness for Bluetooth LE Audio and Auracast broadcast audio.

Feature Comparison: Nucleus 8 Nexa vs. Kanso 3 Nexa

Feature	Nucleus 8 Nexa / Kanso 3 Nexa
Dynamic Power Management	Both
Smart Sync	Both
SmartSound iQ 2 with SCAN 2 & SCAN 2 FF	Both
Bluetooth LE Audio & Auracast readiness	Both
World's smallest and lightest (in category)	Both
IP68 rating	Both
Power Compact rechargeable battery	Nucleus 8 Nexa only
Integrated rechargeable battery	Kanso 3 Nexa only
Buttonless tap control	Kanso 3 Nexa only

Smart Sync — MAPs on the Implant

Because the patient's MAPs are stored directly on the implant's internal memory, they are always available — regardless of what happens to the sound processor. This enables Smart Sync: when a patient places any unprogrammed Nexa sound processor on their implant (e.g., a replacement, upgrade, backup, or loaner device), the MAPs are automatically transferred from the implant to the processor in approximately 20 seconds, with no clinic visit required.



Smart Sync workflow diagram..

During a fitting session, MAPs are written to both the connected sound processor and the implant simultaneously. When a new processor is placed on the implant, Smart Sync completes a one-time transfer of the stored MAPs. After synchronization, the patient is on air and can proceed with re-pairing to mobile devices and wireless accessories. Bilateral pairing information is also stored on the implant, so patients do not need to re-link their bilateral or bimodal pair.

Important Clinical Note: Bilateral Patients

Smart Sync is a one-time transfer. Bilateral Nucleus Nexa patients must be conscious of which side they are placing the new or replacement sound processor to ensure the correct MAP is transferred.

What Is Stored on Implant Memory?

- Up to 4 MAPs, including Hybrid configurations
- Clinical data logs and device/program settings
- MVBT adjustments made in Remote Assist
- Bimodal/bilateral linking information

What Is NOT Stored on Implant Memory?

- Wireless accessory pairing
- Mobile device pairing
- NSA and CR310 pairing
- MVBT adjustments made through the Nucleus Smart App (NSA)
- Setting changes made through the NSA

Section 5: Programming the Nucleus Nexa in Custom Sound Pro 7.1

Design Intent of CSP 7.1 Updates

Custom Sound Pro fitting software version 7.1 was updated with three goals: (1) improve ease of fitting, (2) maximize sound processor battery life, and (3) provide additional diagnostics. These updates specifically support CI1000 implants; programming of all other Nucleus devices remains unchanged.

Why Fitting Defaults Were Updated

The updated default parameters were informed by a big-data analysis of more than 39,000 MAPs in Cochlear's database (Maruthukkara & Bennett, 2022). This analysis found that most parameters were left at default values: 99.3% of MAPs used the default Jitter setting, and 99.47% used the default C-SPL values. The three most frequently modified parameters were pulse width, maxima, and channel rate — reflecting the parameters most likely to require adjustment for compliance and loudness adequacy. The CI1000's Dynamic Power Management enables wider pulse widths without power penalty, and CSP 7.1 takes full advantage of this.

The Relationship Between Pulse Width, Charge, and Loudness

In cochlear implant stimulation, pulse width is equivalent to pulse duration — it describes how long the biphasic pulse is delivered. Total loudness (perceived loudness) is determined by the total charge, calculated as Current x Time (area under the pulse curve). A wider pulse width at a lower current level delivers the same charge — and therefore the same loudness — as a narrower pulse at a higher

current. This means widening pulse width is an effective strategy for achieving adequate loudness without increasing current, which is especially valuable for compliance.

The Value of MAP Compliance

Research from the Mayo Clinic (Saoji et al., 2021) demonstrated that out-of-compliance MAPs — where stimulation is clipped or C-levels are set too low — significantly compromise speech perception outcomes, particularly in noise. In a study of 13 CI recipients, even a 15% signal clip substantially reduced speech scores in multi-talker noise. The clinical takeaway: ensuring MAPs are in compliance is critical for patient outcomes.

Key Fitting Changes for CI1000 Implants

Change	Details
Default pulse width increased	New default: 45.6 µs (up from 25 µs for perimodiolar, 37 µs for lateral wall). Enabled by Dynamic Power Management — no battery life penalty.
Rate-maxima-pulse width linked	For CI1000 implants, pulse width, rate, and maxima are mathematically linked to always keep pulse width as wide as possible for the selected rate/maxima combination. Default: 978 Hz, 8 maxima, 45.6 µs.
Automation of rarely used functions	Jitter is automatically applied for low-rate MAPs. Loudness Growth (LGF) automatically adjusts with changes to C-SPL.
Frequency Allocation Table update	Default frequency table updated to 188–7938 Hz for CI1000 implants.
Starting Global C level	Updated starting C levels reflect lower current requirements with the wider default pulse width.
Expected range updates	Updated compliance ranges in software reflect CI1000 stimulation characteristics.
MAP UID replaces Implant ID	Each MAP now carries a unique MAP UID that must match between the implant and the sound processor. Any change to MAP parameters generates a new UID. Backup processors must be updated in clinic after a MAP change.
Session timing	Additional time may be required at session start (implant firmware updates if needed) and at session end (MAPs saved to both the sound processor and the implant).

Why 978 Hz? Understanding the Rate-Maxima-Pulse Width Relationship

At a pulse width of 45.6 µs with 8 maxima, each biphasic pulse phase takes 45.6 µs with a 12 µs interphase gap and 12 µs interstimulus gap, totaling 115.2 µs per pulse. With 101.4 µs processing time plus 8 pulses (8 x 115.2 = 921.6 µs), the full stimulation frame is 1,023 µs. A rate of 1/1023 µs equals approximately 978 pulses per second — hence the 978 Hz default.

MAP UID and Backup Sound Processors

Because MAPs are now stored on both the sound processor and the implant, each MAP carries a unique identifier (MAP UID) that must match between the two devices for stimulation to occur. This is a safety feature that prevents any unprogrammed sound processor from inadvertently stimulating a patient. Importantly, any change to MAP parameters — including C-levels, pulse width, or electrode status — generates a new MAP UID, which means backup sound processors must be brought into clinic and updated following any fitting change.

Key Takeaways

The Nucleus Nexa System at a Glance

- The Nucleus Nexa System is the world's first and only smart cochlear implant system, featuring upgradeable firmware, internal memory, and onboard diagnostics inside the implant.
- The CI1000 implant is powered by the Cochlear NEXOS chipset — the first new implant chipset in nearly 20 years — built on the proven reliability of the Profile Plus Series.
- Dynamic Power Management, enabled by the enhanced RF link, allows the implant to communicate its exact power needs to the sound processor, improving efficiency and enabling all-day battery life with smaller batteries.
- MAPs stored on the implant via internal memory allow Smart Sync to automatically transfer patient-specific settings to any unprogrammed Nexa sound processor in approximately 20 seconds — without a clinic visit.
- Custom Sound Pro 7.1 introduces updated defaults for CI1000 fitting: increased default pulse width (45.6 µs), linked rate-maxima-pulse width parameters, automated Jitter for low-rate MAPs, and a new MAP UID system for safety.
- Backup sound processors must be updated in clinic after any MAP parameter change, as the MAP UID must match between the sound processor and implant for stimulation to occur.

Notes and Contact

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Notes:

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